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MILITARY AFFAIRS

FOREIGN MILITARY REVIEW

No 9, September 1985

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No 9, September 1985

Except where indicated otherwise in the table of contents, the following is a complete translation of the Russian-language monthly journal ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, published in Moscow by the Ministry of Defense.

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Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 15-19

[Article by Col Z. Gafurov, doctor of philosophical sciences: "Bourgeois Concepts of the Army's Role in Liberated Countries"; passages rendered in all capital letters printed in boldface in source]

[Text] The national liberation movement had moved to new historic milestones by the early 1980's. Colonial regimes had crumbled one after the other under its blows and imperialism's sphere of domination contracted over the last decades. The foundations of a new life were being laid down on the ruins of the colonial and semicolonial systems, and the national statehood, sovereignty and independence of the liberated countries were growing stronger.

All this, not to mention the successes of world socialism and other progressive world forces, engenders furious anger in the imperialist reaction. Hence its attempts to stop the progressive changes in mankind's life, to get back the positions lost in the national and social liberation area, and to get revenge for a number of major defeats suffered in the world arena during the 1960's and 1970's, noted the June 1983 CPSU Central Committee Plenum.

Imperialism disdains no means to halt the progressive movement of national liberation revolutions. Along with stepped-up subversive actions against the developing countries with a progressive orientation, it is taking every step to keep in power the authoritarian bourgeois regime established in the overwhelming majority of states which chose the capitalist path of development.

One of the principal distinguishing features of these regimes is the major role played by the army, which ensures their functioning to the detriment of activities of the democratic organs of control. Establishment of a strong central authority conformed to the plans both of the national bourgeoisie and of international imperialism. Their commonality of class interests stems from the desire to carry out a rapid capitalistic modernization of society, to suppress leftist democratic forces in the country, and to turn the country into a bulwark of the struggle against national liberation movements. Primary reliance is placed on the armed forces in implementing these objectives, which is why western military ideologs are placing special emphasis on elaborating ideological concepts for substantiating the political role of the army as a

tool of imperialism's neocolonialist penetration of its previous holdings in Asia, Africa and Latin America, and as a means of imposing prowestern models of development on the peoples and attracting foreign capital. An army under authoritarian bourgeois regimes also acts as a tool for ideological and moral-psychological conditioning of the population, primarily young people, in a spirit of dedication to the capitalist order and of hatred to all progressive (chiefly communist) trends.

It should be noted that the possibility of the armed forces interfering in politics was almost fully refuted by bourgeois scientists in the first phase of development of these concepts (the 1950's and early 1960's), i.e., in the period immediately preceding and immediately following the winning of independence. "Taking into account that in Africa the armed forces remain insignificant in comparison with the overall numbers of the population and the size of the territory," wrote British political scientist (W. Hatteridge), "they can intervene in the political area only together with other forces such as the police and civil administration. It is unlikely, however, that they would be capable of consolidating their positions and establishing military regimes."

Such forecasts were built on the fact that in this period the West was relying on establishing a system of so-called bourgeois representative democracy in the liberated countries with such inalienable attributes as a parliament, a multiparty system, strict separation of executive, legislative and judicial power, and so on. The introduction of such a system was intended to assure the young states' effective advance toward capitalism, but these plans were not destined to come about. The vices inherent to the capitalist system were being revealed more and more distinctly behind the pseudodemocratic facade of a society being established according to western models: a deepening of social and economic contradictions, unemployment, the dominance of foreign monopolies, erosion of traditional ethical and cultural values, and so on. Under these conditions the imperialist circles which were attempting to prevent leftist forces from coming to power succeeded in provoking military coups in a number of countries resulting in the implantation of dictatorial regimes.

Such a course of events demanded a revision of the initial views on the political role of armies of young states. It was no accident that in his subsequent works, that same (W. Hatteridge) already had to reconsider the active intervention by armed forces in the political life of their countries as an objective reality. Thus entered the second phase in the development of bourgeois theories on the role of the army in Afro-Asian countries (the latter half of the 1960's and early 1970's).

The concept of the "MODERNIZING ROLE" of army circles in transforming a "traditional" society into a "modern" society with the help of developed capitalist countries became the most widespread among these theories. Its substance consists of the attempt to substantiate the capability of armed forces to ensure that the customs and spiritual values inherent to bourgeois society are implanted and consolidated in young sovereign states.

One more direction of neocolonialism originated as a result. Its representatives saw the young national armies as a "tool of modernization" and a new

force which was destined to implement the western politicians' calculations in the zone of the national liberation movement. This is not surprising, inasmuch as western sociologists were proceeding above all from the assumption that, with a monopoly on weapons, armed forces are capable of successfully fulfilling punitive enforcement functions while accomplishing political tasks. In addition, the army acts almost as the only cementing, uniting force in a society divided by tribal, racial, religious and language barriers. The works by bourgeois authors also attach great importance to the officers' level of education, administrative and technical training, and capability of being consistent adherents of society's comprehensive, rapid scientific-technical progress with the West's help. Finally, in an attempt to depict the army as a technocratic formation independent of class, western theorists emphasize its inherent alignment on the outside world, by which they mean the world of capitalism and the armed forces of imperialist powers.

Just what is the true class meaning of this bourgeois concept? Just what is that social order which theorists of the "modernizing mission" of armed forces in young Afro-Asian states have implemented and are implementing sometimes openly, sometimes secretly, but always rather precisely? Progressive foreign ideologs identify three basic points in answering this question and thus revealing the groundlessness of that concept.

First of all, while extolling in every way the "modernizing" activity of the prowestern military in liberated countries, imperialist circles always have attempted to use them to prevent that development of events which could bring to power revolutionary forces intending to put an end to their homeland's independence and to imperialist exploitation. These circles have demagogically or, more precisely, openly falsely dubbed this objective a "struggle against communism." In this case all patriotic and democratic elements of developing society are taken to be communist. The action by the Indonesian Army under the leadership of a right-nationalist grouping of the officer corps in 1965, for example, had a preventative nature. The military coup pursued the objective of preventing a possible victory of the national democratic revolution which was about to happen at that time and establishing conditions for the country's development along a capitalist path. Largely similar tasks were set for themselves by officers of western schooling in Ghana and Mali who overthrew the revolutionary democratic governments of Kwame Nkrumah and Modibo Keita in 1966 and 1968 respectively and thus interrupted these countries' further advance along the path of socialist orientation.

Secondly, the concept of the army's "modernizing role" has served and continues to serve as a unique "cover" for capitalism's development in the so-called Third World. According to this concept, the army must provide conditions for development of the local bourgeoisie, which in a majority of the developing countries is distinguished by weakness and unpopularity among the masses, who see in it a social force that does not stand alone and is dependent on international monopolies. Western powers see the attempt to find a certain "substitute" or surrogate for the bourgeoisie as a solution to the situation where capitalism has to develop in economically backward countries in the absence of sufficiently developed capitalist relationships. According to their calculations, the local army must become that surrogate.

Thirdly and finally, this concept also is intended to promote the attainment of a strategic objective of imperialism such as subordination of enormous areas of the former colonial and semicolonial world to imperialist powers headed by the United States, which will make it possible for the latter's monopolies to exploit these areas' natural and human resources. By keeping prowestern officers in power as "modernizers" and "reformers" of archaic social and economic structures, the West can impose military assistance on the liberated countries, continuously build up arms deliveries, and draw those countries into western blocs. When we look at Asia of the 1960's, we see that specific policy being followed by the United States with respect to Thailand, South Vietnam, Pakistan and other countries. Today as well, by encouraging dictatorial regimes and the arms race they are conducting, ruling circles of the United States, France, Great Britain and Israel do additional damage to their weak economies. With the retention of certain political conditions, all this inevitably dooms the young states to even greater dependence on the former home countries.

But it was in the late 1960's that the situation in Asia and Africa convincingly attested to the insolvency of the majority of fundamental theses of this neocolonialist concept. As a matter of fact, the ruling military caste in states with a capitalist orientation gradually turned into a bourgeois bureaucratic layer and wallowed in corruption. A thirst for personal enrichment and not concern for the country's future more and more became the main motivating reason for its activity. That was how things stood in the 1960's in such African countries, for example, as Upper Volta (now Burkina Faso), Zaire, Rwanda, Equatorial Guinea, Ghana (following the military coup of 1966), Nigeria and the Central African Republic. In many respects a similar situation existed in a number of states of Asia--South Korea, Thailand, South Vietnam and others. In all these countries prowestern officers set up what were actually military dictatorial regimes, but they not only did not accelerate, but even retarded the solution to urgent problems. It could not be otherwise. In the words of R. (Ferst), a progressive woman journalist and active participant in the African national liberation movement in the Republic of South Africa, the selfish interests of the elite, including the military, are incompatible with a solution to the tasks of uplifting the economy and eliminating poverty.

The western-centrist orientation of purely military regimes and their reliance on a capitalism which was dependent on the leading imperialist powers led to a development which in the majority of instances bore a semicolonial, abnormal character. The political instability of military regimes with a capitalist orientation became the natural result of a stagnation of the economy and the ignoring of pressing needs of the masses, and this instability was manifested in the frequent change in regimes. Suffice it to say that during the 1960's some countries, both African and Asiatic, experienced not one, but several military coups (Ghana, Upper Volta, Togo, South Korea, Thailand, South Vietnam and so on).

The neocolonialist reliance on bourgeois modernization with the help of governments dependent on the West and headed only by the military thus became less and less acceptable even for the former colonialists, not to mention the progressive forces.

Meanwhile, back in the 1960's the successfully developing countries with a socialist orientation served as a vivid positive example for army circles dedicated to the people's cause. The number of such countries continued to grow (Syria, Burma, Algeria, People's Republic of the Congo, Tanzania, People's Democratic Republic of Yemen and others). The absolute majority of them established stable regimes based on a national democratic power which rather successfully reorganized the economic and social foundations of society and attempted to take advantage of the achievements of the scientific-technical revolution and advanced social thought. Their first successes in reorganizing the obsolete socio-economic system in order to establish the foundations for building socialism in the future demonstrated once again the total state of decline of the neocolonialist idea that transformation of an old society to a modern footing is possible only through capitalist development under the cover of military dictatorial regimes.

This is why other antiscientific concepts of the armed forces' role in determining the paths of further development of the liberated countries appeared in the late 1960's and early 1970's (which of course does not mean a loss of importance for the concept described earlier). This marked the onset of the following third phase in the development of bourgeois views on the army's role in former colonies and semicolonies, a phase which continues to this day. A large number of antiscientific interpretations of the role of armed forces now are coming to replace the "modernizing" theory.

Within this motley mishmash of reactionary views, aims, assessments and opinions one can single out a concept which unites them to some extent. This concerns the theory of the "PRAETORIAN" role of the army in countries freed from colonial domination, developed by American political scientist S. Huntington. In explaining its meaning, he stresses that the theory itself is a component part of a still broader concept of the so-called "praetorian society." The substance of the latter's model is that under conditions of a growth in the political instability of existing regimes and in the activeness of the masses it is necessary to reject the idea of democracy as the immediate objective for the political development of liberated countries and recognize authoritarian-bureaucratic regimes with the active participation (but not domination) of the military as more suitable for young national states.

With respect to the concept of the army's "praetorian" role in these countries, Huntington compares the behavior of army circles in developing countries and the praetorians of Ancient Rome and asserts that an active participation in the struggle for power is inherent to both.* In his opinion, however, this struggle should prompt the army not to strive for its own individual power, but to share it with the civilian bureaucracy by establishing together with it a firm, authoritarian power of the military and civilian elite. This is the fundamental meaning of the "praetorian" concept of the army and its chief distinction from the "modernizing" concept.

*The guard for military leaders of Ancient Rome initially were called praetorians, and later that was the term given to the guard of the Roman emperors. In the figurative sense the praetorians are the basis of power which relies on brute force--Ed.

And so, beginning with the 1970's and continuing to this day, western strategists proceed from the assumption that the army's undivided political domination is possible only as a temporary stage in the life of a young state. A delay in the stage of army rule is considered potentially dangerous with the separation of military rulers from existing bourgeois groupings and with the narrowing of their class base, which leads to the regime's general instability.

This change in bourgeois concepts, however, certainly did not mean that the imperialist stategists had rejected the previous course toward maximum use of the military for their selfish purposes. The only thing new was that the army's continuing mandatory participation in political life now was conceived as its alliance and close cooperation with the civilian bureaucracy--the highest state bureaucrats with whom the army command element has a common social origin and common interests. Taking Asia as an example, these are the sort of authoritarian, military-bureaucratic regimes which have existed intermittently for some two decades now in Pakistan, South Korea, Thailand, Bangladesh (since 1975) and in South Vietnam up to 1975.

The imminent threat of social shocks forces the ruling circles of these and similar countries in Africa (such as Zaire) to reject purely military dictatorships and to cloak regimes in a "democratic facade" in order to broaden their social base by means of the national bourgeoisie above all. But the ruling groupings plan to conduct "liberalization" under the strict control of the existing military-political apparatus to prevent broad masses of people from taking an active part in political life. The military-police apparatus continues to be called upon to fulfill repressive functions with respect to the workers in order to give the "liberalization" process a strictly controlled nature and prevent it from going outside the narrow bounds of a "special type of democracy" in the belief that, in contrast to the western model of bourgeois democracy, the "special type of democracy" must rely on traditional foundations and institutions. At the same time, the repressive organs must ensure a return to an open military dictatorship if the need arises for forcible suppression of opposition forces and the progressive movement.

Historical experience indicates that during a certain stage such regimes of "controlled democracy" are capable of providing for a "compromise" conformity of the basis and the superstructure, i.e., they are capable of keeping the sociopolitical forces existing in society in a relative balance by forcible means. As society gradually moves forward, however, the balance inevitably is disrupted and another crisis of social structures arises. The political situation just was not able to be stabilized in the aforementioned countries in this sense.

The situation of the Zia-ul-Haq regime in Pakistan, for example, is becoming more and more complicated. Its disgraceful role in the aggressive politics of international imperialism directed against neighboring Afghanistan, a policy also joined by some reactionary Muslim countries, also is of substantial significance here. The close alliance with the reactionary Muslim countries as well as the strong influence of extremely reactionary Islamic organizations (such as "Jamaat-i-Islam") among a portion of the officer corps predetermined

to no small extent the special turn of Pakistan's military-bureaucratic regime toward the most reactionary and narrow current in Islam. But the full meaning and significance of this turn as one of the few remaining means for self-preservation becomes understandable only against the background of that steady narrowing of its social and political base which has been seen in recent years. Despite repressions and persecutions, the wave of antigovernmental demonstrations which are gripping increasingly broad layers of the people has been growing in Pakistan during 1984 and 1985. Today their participants are demanding a restoration of democracy, an improvement in living conditions, and the following of an independent foreign policy course which is in the country's fundamental interests.

Specifically where is the reactionary meaning of the concept of the armed forces' "praetorian" role in developing countries manifested?

First of all, the antiscientific nature of this concept is reflected in the fact that its adherents consider the army's development in isolation from basic trends in the class development of young states and depict it as some sort of grouping independent of class capable of conducting urgent reforms independently without reliance on the classes and layers most concerned with them. S. Huntington himself approaches the army as a single whole which does not contain any internal social contradictions. He does not see or does not wish to see that the military's deep-seated economic and class interests lie behind their intervention in politics and so in some cases such intervention will be progressive and in others it will be conservative.

Secondly, creators of the "praetorian model" of an army also refuse to consider the basic fact that, as in the bourgeois armies of western states, the uniformity of the class function in armed forces of Afro-Asian countries with a capitalist orientation is not backed up by a uniformity of the personnel. Regardless of the methods of manning, armed forces usually reflect society's class structure. Contradictions between the exploited majority and the small command hierarchy which represents the interests of the exploiters, and contradictions between the class make-up and class purpose of the army become especially obvious in such armed forces. They caused a split, for example, in Burma, the People's Republic of the Congo, Benin, Ethiopia, Madagascar and other Afro-Asiatic countries which had become the arena of national democratic revolutions. The highest command personnel here were removed in the very first days of the revolution, which allowed the armed forces to act almost entirely on the side of the people. In addition, there are certain contradictions between the older officers who took root in the system of political power, who were corrupted and wallowed in business, and the junior officers who had not yet become rooted in the "circulatory system" of the given regime, as well as contradictions between enlisted men and officers. All this creates an objective social-class basis for a division of the army, for establishment of control over it by its revolutionary part, and for subsequent action by practically the entire army as the vanguard force of the national democratic revolution.

The deepest such split of an army into the relatively small number of generals and higher officers on the one hand and the privates and NCO's headed by

junior officers on the other hand occurred in Ethiopia prior to and during the antimonarchical, antifeudal revolution of 1974. A division of the army into two opposing camps was revealed in particular during elections held in military units in the fall of 1974 to the Armed Forces Coordination Committee (KKVS) and later to the Provisional Military Administrative Council (VVAS), which was the controlling center of the people's movement. General servicemen's meetings in units and subunits elected 120 delegates to the Armed Forces Coordination Committee after it was reorganized as the Provisional Military Administrative Council. The delegates primarily were from the lower strata, people known for their democratic convictions and who had a rank no higher than major. The rebel army did not trust generals and highly placed officers. As a result the popular masses of Ethiopia gained an organized vanguard of the victorious national democratic revolution in the form of the Provisional Military Administrative Council, which headed the army and revolution.

Finally, one more very important expression of the antiscientific, reactionary essence of this concept is its ignoring of the domestic and especially the international conditions in which young national armies function. In the modern era the development of progressive aspirations of officers is influenced by the fact that many officers, primarily young ones, saw the only real path toward national rebirth, the elimination of backwardness and establishment of social justice to lie in the implementation of profound anti-imperialist, antifeudal transformations, a limitation of bourgeois development, and a socialist orientation. The decisive factors here are an upsurge in the workers' struggle against rotten, corrupt regimes, the stormy process of the world's revolutionary renewal, and chiefly the historical successes of a socialism that really existed and its effective support of fighters for national and social liberation. The training of officers in socialist countries also played no small role in this regard.

The insolvency of modern bourgeois thought about the place of armed forces in liberated countries also is manifested in the fact that in recent decades there has not been any more or less finished concept developed which could be placed in the same rank as those examined earlier. On the other hand, works continue to appear in great numbers by authors who elaborate recommendations for stabilizing military regimes of a capitalist orientation which have come to power (which is connected with their noted instability and shortlived nature). Such authors advise the military who have come to power how best to consolidate in their positions and share the power with civilians. They don't recommend a probourgeois ruling military hierarchy inclined to use bureaucratic methods of rule to become apart not only from the army mass and junior officers, but also from the civilian bureaucratic elite, since this can cause dissatisfaction in the armed forces and in the country as a whole and lead to new shocks. In their opinion, the principal means for stabilizing existing orders is to carry out minimal "cosmetic" reforms in order to ease the people's situation somewhat.

And so the army's role in choosing the paths of postcolonial development has become an object of very acute ideological opposition in the liberated countries. This struggle is indicated by the imperialist ideologs' desire to achieve the undivided rule of bourgeois views, to put an obstruction in the

path of the spread of the Marxist-Leninist teaching on the army within those countries, to impose neocolonialist social-political and organizational-technical models of military organizational development on the peoples, and to prevent the development of cooperation with the Soviet Union and other socialist countries.

The most important social function of the "modernizing," "praetorian" and other concepts being propagandized by western theorists and sociologists is the deception of the popular masses with respect to the substance, character and purpose of armed forces in a class society in general and in developing countries in particular. Western ideologs address to the liberated states works called upon to slander the social-political nature of socialist armies and to falsify their historical purpose and the place held in society. The reactionary nature of bourgeois concepts of the armed forces' role in the liberated countries' choice of paths of further development is a specific manifestation of the general crisis of bourgeois ideology in the modern era.

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MILITARY EQUIPMENT CAMOUFLAGE IN NATO COUNTRIES

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 20-21

[Article by Lt Col A. Mironov and Lt Col M. Menshikov]

[Text] While building up militaristic preparations, the leadership of the aggressive NATO bloc is attempting to conceal their content and scope and to lead the probable enemy astray. Camouflage is considered an important means for achieving that objective, especially at the operational and tactical level. As pointed out in the western press, camouflage includes a set of measures for concealment and for deceiving the enemy regarding the plans of the friendly command and the location and status of forces and military objectives. The experience of local wars of recent years, especially those in which camouflage played the greatest role (the 1973 Arab-Israeli War and the 1982 Anglo-Argentine Conflict) is taken into account when camouflage instructions and rules are drawn up. Leading NATO experts assume that these measures must be organized by command elements and staffs at all echelons and must be regarded by them as an important factor for preserving the combat effectiveness and survivability of large and small units and for attaining surprise and success in an action or an operation.

In accordance with the provisions of long-range programs for military organizational development and with the requirements of the bloc's managing bodies for improving the effectiveness of camouflage in member countries, and above all the FRG, United States, Great Britain, Denmark and the Netherlands, working commissions have been established on a national and multilateral basis for conducting active research and development in this area. Their work is directed and coordinated by a special NATO group of experts on camouflage. Western military experts place priority emphasis on camouflage of the combat equipment in the inventory of large and small units, especially the tanks, infantry fighting vehicles, armored personnel carriers and artillery systems. Camouflage paint is considered the most widespread method for concealing this equipment on the battlefield. NATO countries are performing important R&D to develop new paints and to work out and standardize the methods for camouflage painting. Specialists have been given the following tasks: to ensure that camouflage resources conform to conditions of Central Europe; and to ensure the possibility of their around-the-clock use and concealment of armored equipment at a distance of 800-3,000 m, depending on the systems.

In 1979 U.S. and FRG military specialists began developing a new camouflage cover based on black, brown (grayish brown) and green colors, designed to replace the existing four-color cover. The three-color camouflage cover was approved by representatives of both countries' ground forces after comparative tests in the summer of 1983. As field testing showed, the adopted coloration is more effective compared with that previously used. The time taken to locate an object camouflaged by the new method increased 1.5-2 times and the probability of visual detection dropped 1.5 times.

The U.S. and FRG ground forces already have begun to introduce such a cover. In particular, the Leopard-2 tanks being manufactured by a West German firm are to have the new camouflage coloration beginning with the 1150th. The NATO command recommends its adoption in the ground forces of the other member countries as well.

Reports recently appeared in the foreign press about the development of a chemical foam designed to camouflage combat equipment. Technical devices for applying it to the surface of an object also have been developed. The camouflage effect lies in a reduction of the object's infrared emissions. Applied to a surface, the foam takes on the ambient temperature and thus makes the object difficult to distinguish for thermal-imaging reconnaissance equipment.

Intensive work is being done in the area of improving camouflage for the purpose of reducing the level of infrared (thermal) emissions of combat equipment, primarily tanks, by using thermal insulation and screens, and by developing new cooling and ventilation systems. There have been tests of the possibility of infrared camouflage of fixed objects, and measures have been outlined for implementing this. In the future it is planned to develop unified requirements for measures to conceal objects from infrared resources.

Camouflage nets (Fig. 1 [figure not reproduced]) are a rather widespread means of concealing weapons and military equipment. Foreign specialists are trying to develop general-purpose covers which would camouflage an object in several bands of the electromagnetic spectrum simultaneously in order to hamper its detection not only visually, but also with radar, cameras and infrared reconnaissance equipment. Contemporary camouflage nets most often are made of synthetic materials with interwoven metallic threads, they have a reversible coloration and they consist of separate parts adapted for rapid assembly or disassembly of the cover. Different versions of such covers are being developed for camouflaging objects depending on terrain and seasonal conditions.

In recent years military specialists of the NATO countries have been placing great emphasis on developing smoke means of camouflage, which are considered rather effective. Computer simulation of combat actions has established that the use of smokes will help reduce friendly troop losses by one-fourth and will cut the enemy's rate of advance in half. They assume that screening smokes can find use in accomplishing the following missions: depriving the enemy of information about friendly troops; reducing the effectiveness of enemy guidance devices and weapon sighting systems; disrupting or hampering enemy troop movements and his command and control and communications; reducing the capabilities for aerial reconnaissance of the terrain; creating conditions for achieving surprise in friendly troop actions; and deceiving the enemy.

In the opinion of western experts, a mandatory condition for effective use of smoke resources is to work out various tactical procedures for their battlefield use with consideration of terrain features, time of year and day, and climatic and weather conditions.

A number of NATO countries are actively developing principles of the tactical use of simulation resources (mock-ups, decoys and so on). Foreign specialists consider the use of mock-ups and other dummy facilities for camouflaging weapons and combat equipment to be one of the methods of deceiving the enemy and providing false information. Such resources presently are made of improvised means or out of materials which are being specially developed.

Inflatable mock-ups also have become widespread. They have a great resemblance to objects being concealed both in external appearance and reflection characteristics. The inflatable mock-ups are placed in a ready condition, taken down and stowed in a short time using a minimum number of personnel. For example, it takes a group of 6-8 persons no more than one hour to prepare a dummy position for a Hawk surface-to-air missile system consisting of nine launcher mock-ups (developed in the FRG, Fig. 2 [figure not reproduced]). The NATO leadership, however, attaches somewhat less importance to that method of camouflage. In particular, the foreign press points out the absence of unified guidance documents in this area and the continuing differences among officials of bloc countries regarding the effectiveness and prospects for using simulation resources under present-day conditions. Nevertheless, competent NATO circles took into consideration the basically positive results of studies performed on this problem with the participation of their representatives with the aim of deceiving the enemy.

Along with the traditional methods of disruptive painting and coloration, the task of reducing the contrast of surfaces of runways, highways and other fixed objects by using materials for construction which are given a green color by special pigments has been posed and is already being partially resolved in order to improve the camouflage of fixed objects. Such a runway is being made, for example, at the FRG's naval aviation airfield of Nordholz.

NATO military specialists believe on the whole that in order to employ camouflage resources successfully it is necessary to use them all together, to consider local conditions and capabilities of enemy reconnaissance, and constantly assess the effectiveness of such resources.

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DISCUSSION OF DEVELOPMENT OF U.S. SPECIAL FORCES

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 21-23

[Article by Col I. Belov: "The Pentagon: On a Course of Terrorism and Nuclear Subversion"; passages rendered in all capital letters printed in boldface in source]

[Text] International piracy, aggression and expansionism have become the basic directions in American imperialism's foreign policy course. Along with the unchecked build-up of the country's military potential, U.S. ruling circles are constantly perfecting the means of terror and subversion used widely both during war and under peacetime conditions in order to achieve their objectives. This not only concerns the not unknown center of espionage, the CIA, but also the Pentagon, which is joining actively in this work.

The size of the American Armed Forces Special Forces (VSN) has been increasing constantly in recent years. They are supplied with the most up-to-date weapons and combat equipment, including nuclear mines for carrying out subversive operations in the enemy rear. The contingent of these forces increased especially noticeably under the Reagan administration, when they more than doubled. Fiscal year 1984 appropriations for them, for example, were doubled in comparison with the previous year and comprised over $500 million. An even larger amount ($600 million) is being requested for fiscal year 1986.

The Special Forces were established in the United States in 1942. The size of these forces increased considerably in 1968 in connection with the aggression in Vietnam, but a portion of them were deactivated following the failure of that adventure. As the foreign press reports, the Special Forces presently number over 20,000 persons, or 32,000 together with reserves. A subsequent growth in their numbers is planned; by 1990 they are to be increased to 38,500, including reserves. There are Special Forces in all branches of the American Armed Forces.

The contingent of Special Forces IN THE ARMY comes to 10,000 persons. They are headed by a Special Operations Command established in 1982 and located at Fort Bragg, North Carolina. According to reports of the West German journal SOLDAT UND TECHNIK, they include seven special operations groups (21 battalions)--the so-called Green Berets; a regimental headquarters and three Ranger

battalions--the Black Berets (Fig. 1 [figure not reproduced]); four psychological operations groups (12 battalions) and a civil affairs battalion, i.e., a battalion for working among the civilian populace (spreading rumors to cause dissatisfaction and panic, recruiting turncoats for conducting subversive actions against progressive regimes, and so on). The size of a special forces battalion is around 200 persons, of whom 25 percent are officers.

Special Delta subunits have been formed as part of the Green Berets for protecting state figures and U.S. establishments abroad; for conducting terrorist operations (Fig. 2 [figure not reproduced]) in countries in which the United States has "its interests" for the purposes of carrying out coups d'etat there; and for preserving puppet regimes and conducting reprisals against the patriots. An unsuccessful attempt was made to use these terrorists in Iran in 1980 in particular. They presently are being used widely in developing countries on all continents, primarily in Central America, the Near East and Africa.

A special helicopter detachment codenamed TF160 (Task Force 160) was formed in the U.S. Army Special Forces in 1981. Its purpose is to transport saboteurs and terrorists to their operating area. The helicopters are fitted with equipment for night flights.

IN THE AIR FORCE special-purpose units and subunits (up to 5,000 persons) include an air wing (five squadrons), two air reserve groups (three squadrons) and a helicopter detachment equipped with Night Hawk helicopters. These subunits are assigned to perform reconnaissance missions, to cover operations from the air and to transport the special operations subunits.

The special-purpose forces of the NAVY (some 5,000 persons) are made up of two special-purpose groups, which include three special operations (frogman) detachments, five detachments of demolition experts--the so-called SEALS (Sea-Air-Land Soldiers) detachments, two detachments for delivering the demolitions personnel to their operating area, and two squadrons (six subunits) of special patrol craft. It is planned to form another two demolition detachments. There are some 1,000 persons in the Marine special-purpose subunits.

The foreign press reports that two nuclear-powered submarines, the "Sam Houston" and the "John Marshall," presently are being refitted as commando transports. Demolitions personnel and frogmen will be aboard them constantly in readiness for immediate employment. These submarines will ply areas of probable intervention, above all where there are no American bases; the Near East area is mentioned in first order. The movement of such subunits also is planned by air, including by paradrop.

The Special Forces primarily are located in the United States, but one battalion of Rangers each is permanently stationed in the FRG and in Panama. There is also a number of American psychological operations subunits located in West Germany.

The Pentagon widely uses special operations subunits for training the cutthroats of puppet régimes in order to keep U.S. proteges in power, and for direct participation in so-called "counterinsurgency operations," i.e., for

reprisals against patriots, for organizing the bandit operations of the Contras (against Nicaragua out of Honduras and Costa Rica), for committing terrorist acts against progressive figures, and so on. The foreign press reports that from 1975 through 1983 there were 532 such teams "working" in 58 countries, and they were used in 35 countries in 1984. Their bloody traces remained in Vietnam, Lebanon, Somalia, El Salvador, Nicaragua, Colombia, Grenada and many other states.

The Special Forces are trained to perform reconnaissance, sabotage, subversive actions and terrorist acts; to organize subversive actions against legitimate governments and counterinsurgency warfare against the patriots both in peace and wartime; to demoralize enemy troops, and so on. Considerable emphasis is placed on teaching them foreign languages, on their orientation on the terrain, and on survival methods. The foreign press indicates that in addition to other weapons, the Green Berets and Black Berets are armed with 27 kg man-portable containers with 1 KT nuclear explosive devices. They are intended for destroying the most important military and economic objectives and sealing off mountain passages, freeways and tunnels. The western press reports that American subversive subunits in the FRG have 100 such containers. One of these subunits is located in the Upper Bavarian city of Bad Tölz.

In addition to other equipment, the psychological operations groups are supplied with portable equipment simulating the noise of tanks and helicopters to create the impression of considerable strength and well-armed groupings of friendly troops in order to sow panic among the enemy and compel him to surrender.

In 1984 the Pentagon established a Joint Special Operations Agency to coordinate the employment of special forces of all branches of the U.S. Armed Forces.

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ENGINEER COMBAT SUPPORT IN THE ARCTIC: FOREIGN MILITARY SPECIALIST VIEWS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 25-29

[Article by Col (Res) Yu. Korolev, candidate of military sciences, docent; and by Col (Res) V. Shamshurov, candidate of military sciences, docent; passages rendered in all capital letters printed in boldface in source]

[Text] Having set a course toward the arms race and preparation of war against the Soviet Union and other socialist states, imperialist circles of the United States and its allies in the aggressive bloc are placing great emphasis on preparing their armies to conduct combat actions in various regions of the world, including regions of the North which include arctic and subarctic zones comprising some 45 percent of the North American continent and 65 percent of Europe and Asia. For many years the United States and other NATO countries have been taking practical measures to study polar zones and the tundra and to establish air and naval bases in the northern part of Scandinavia, in Greenland and in Alaska. Each year various exercises are conducted in the arctic regions during which existing models of combat equipment and gear are checked out and new models are tested to check the possibility of employing them under conditions of a cold climate. Various scientific research laboratories, test ranges, scientific centers and stations have been established in Alaska and Greenland to accomplish these tasks.

American military specialists believe that the following factors have a substantial effect on troop combat actions and their engineer support in arctic regions: very cold weather, snowfall and deep snow cover in the winter months, the presence of permafrost, the long duration of warm weather in winter and of hours of daylight in summer, strong winds, an absence of a far-flung network of highways and railroads, the lack of clearly visible reference points and of construction materials, and so on. It is noted that in winter the soil can freeze to a depth down to four meters and that water obstacles, marshes and bogs which are difficult to negotiate in summer become suitable for troop movement after freezing. In summer the troops have an increased need for bridging resources, amphibious vehicles, air cushion vehicles, as well as the timber necessary for reinforcing the roadway of routes over difficult sectors of terrain (or for building corduroy roads).

Foreign military specialists believe that it takes considerably more time, forces and resources to perform engineer missions of support to troop combat actions under conditions of a cold climate than under ordinary conditions. The factors of time and space change here depending on the nature of terrain, time of year and the weather. Distance often is determined by the time spent covering it, and not by mileage. This is why planning must be thorough and comprehensive. It is believed that commanders at all levels must issue orders calculated so that the troops have sufficient time to perform combat support missions.

The demands on engineer support increase by virtue of the stern climate and difficult terrain conditions, with the scope of engineer missions for supporting troop mobility and survivability increasing in particular. The limited number of roads and airfields makes it necessary to lay or prepare them. Timely preparation of combat positions, ammunition supply routes and routes for troop advance and maneuver acquire special significance. Importance is attached to determining the load capacity of ice on ice crossings in winter and to the availability of specialists in the use and repair of crossing equipment in summer.

Serious attention is given to the ability of the personnel (especially scouts and individual groups) to get their bearings on the terrain. The foreign press reports that a special device has been developed which permits determining a person's location on terrain of any category of difficulty at any time of day or year, and to measure distance covered. The device includes a compass, azimuth indicator-index and a plotting board on which the person's course is plotted, as well as a distance meter attached to the leg.

Selected engineer combat support missions accomplished in order to improve troop mobility and survivability are examined below.

In the views of foreign military specialists, ROADS AND CROSSCOUNTRY ROUTES in arctic regions are of priority importance. The main supply routes and primary lateral lines of communication are prepared in the jumping-off place. Access routes are prepared from the main supply routes to battalions, artillery and missile subunit firing positions, control posts and reserves. First echelon battalions lay crosscountry routes to the forward edge from their locations. The belief is that in an attack they are prepared figuring one per first echelon brigade and one or two per division. The road network in the defense includes main supply routes, the primary lateral lines of communication and access routes to positions. Maximum use is made of existing roads when preparing them. Engineer and engineer construction subunits, companies of engineer vehicles and subunits of combat arms are used for the work. In winter roads usually are laid over the ice of rivers and lakes or across frozen marshes. In summer elevated sectors of terrain, river floodplains, streams, shallow rivers and lakes with a gravel bottom are chosen for them. The construction and maintenance of winter roads for transport as well as clearing or packing snow on roads and routes of all types assumes great importance. It is recommended that the snow be packed using a road roller for constructing a crosscountry route.

In some regions it is advisable to use rivers for preparing winter roads, since in this case it is necessary merely to clear the snow and to build up the ice in some places if necessary. It is specified that routes be chosen along lakes and rivers only after a thorough engineer reconnaissance of ice conditions along the entire route. The belief is that the ice must be 55 cm thick to pass a 5-ton vehicle, and 80 cm thick to pass an M60 tank. Great emphasis is placed on maintaining ice roads or routes, for which the presence of cracks on the route must be checked daily and ice cover thickness measured every 300 m once a week. An ice crossing 1.6 km long and 9 m wide was prepared in one of the exercises held in Alaska; it operated for two weeks and supported the crossing of combat equipment.

It is recommended that roads and crosscountry routes be immediately cleared following snowfalls so that the fallen snow doesn't have time to harden. Snow is removed not only from the road, but from the sides as well. Engineer subunits with road construction equipment and snow plows are assigned for this purpose. It is believed that the use of tracked snow plows is especially convenient in working on large masses of dense, compacted snow layer by layer. In some cases front loaders can be used for snow removal.

Foreign military specialists note that air transport and ground equipment with improved trafficability, including air cushion vehicles, should be used more widely to improve troop mobility in northern regions. The foreign press has reported that articulated tracked combat support transporters purchased in Sweden are being provided to the 172d Separate Infantry Brigade and National Guard subunits stationed in Alaska.

Terrain FORTIFICATIONS are prepared with consideration of the relief, the terrain's soil and geological conditions, and time of year. When preparing jumping-off places it is recommended that facilities prepared for defense be used above all and that only the deficient number of emplacements for tanks and infantry weapons and very simple personnel shelters, including shelters from the cold and bad weather, be built anew. Mechanical means, explosives and standard structural components should be used widely to prepare the areas to be occupied by troops before an attack.

Fortification of terrain on the defense is organized most completely on likely avenues of enemy attack. Company and platoon strongpoints prepared for an all-around defense are the basis of positions on these avenues. It is deemed best to prepare the strongpoints on terrain which would force the enemy to attack over deep snow, and uphill if possible (especially on mountainous tundra). It is noted that because of concealment, defensive positions located in deep snow are less subject to enemy fire pressure. Not only the relief and nature of soils, but also the depth of snow cover must be taken into account in selecting the forward edge of positions.

A minimum amount of fortification is accomplished on secondary axes and difficult terrain sectors. Individual strongpoints and centers of defense are set up here along roads and trails leading to tactically important terrain sectors and objectives. There usually is no fire coordination among them.

Artillery firing positions and tactical missile launch positions are located near roads and crosscountry routes and on reverse hillslopes. On level tundra they are at a considerably greater distance from the forward edge than under ordinary conditions. Primary, alternate and dummy positions usually are prepared. It is noted that under winter conditions there is increased need to set up an additional number of alternate firing positions for a piece (to be occupied later), since when fire is conducted in low temperatures a revealing condensation trail appears, extending the entire distance of the trajectory from the firing location to the impact point.

Fortifications that are buried, semiburied, and with breastworks and parados may be constructed at troop positions and locations depending on the soil type, ground water level and time of year. Structures with breastworks and parados and semiburied structures are made of rocks and gravel (gabions), frozen soil, snow and ice. Permacrete or so-called ice concrete (snow that is moistened and mixed with sand, clay and gravel) and snow bricks also are used in building structures for observing, for conducting fire, and sheltering personnel and equipment in winter, with a subsequent freezing of an ice crust on the structure's surface. The belief is that the 1.4-2.5 m walls and roofs of such structures protect the personnel against bullets and fragments and considerably reduce the effect of penetrating radiation. Bunkers and shelters for protecting and warming the personnel are built using factory-made components. It is recommended that thermal insulation measures be taken (walls are covered with canvas, felt, and synthetic or other materials). It is noted that the time needed for building field defenses under arctic conditions increases fourfold in comparison with normal conditions, even if explosives and machines are used.

Unfrozen soil free of snow should be used if possible to build breastworks and overhead cover and to fill sandbags. In mountainous tundra it is recommended that fortifications and shelters for the personnel and equipment be made on mountain slopes. Demolition charges, power drills, special tools and compressor units are used in constructing facilities in rocky and frozen soils as well as under permafrost conditions. Special demolition sets are used for digging individual and group emplacements, and the drilling and blasting method of loosening the soil, and excavators, are used for digging pits.

Open-type fortifications (emplacements, trenches, connecting passages) are cleared of snow following a snowfall.

It is recommended that ENGINEER CAMOUFLAGE MEASURES be taken with regard for specific terrain conditions, climate and time of year. Concealment against observation from the air assumes special importance in northern areas. In order to conceal troops and objectives it is recommended that existing natural screens and various standard and special camouflage materials be used and that camouflage paint be applied to equipment. It is believed difficult to conceal a considerable number of shelters, tents and other facilities on open terrain and so it is best to place great emphasis on measures for deceiving the enemy (establishing dummy objectives, simulating troop locations and positions, and so on). To this end it is recommended that mock-ups of weapons, combat equipment, emplacements and tents made of snow, branches and canvas be used, and

that oil or gasoline be burned in small quantities to display signs of life there. Already existing tracks should be used to conceal combat equipment movement, and new tracks should be made and connected with existing roads. Where this is impossible, a large number of tracks should be made on the terrain in various directions. It is believed that all other techniques of camouflaging tracks do not provide satisfactory results.

MANMADE OBSTACLES ARE BUILT in northern areas with consideration of the terrain's passability, which depends on the nature of relief, soil, depth of snow cover and time of year. It is noted that vegetation and natural obstacles retain the snow, and its depth may hamper troop movement. For this reason it is recommended that obstacles be made primarily on those defended terrain sectors where the snow cover is insignificant and which are easily negotiated by the enemy. In summertime lakes, rivers and marshes may present difficult obstacles for combat vehicles and personnel.

According to the views of foreign military specialists, all kinds of obstacles can be used in northern areas: nuclear-mine, antitank, antipersonnel and antilanding obstacles. The first ones are best placed on main roads, in narrow places of troop passage, in accessible sectors, on exposed flanks and in gaps between units.

The second type of obstacle consists of minefields, boulder piles, demolished roads, as well as collapsed cliffs and tree barriers. In winter it is recommended that river and lake banks and hillslopes be iced. Frozen reservoirs can be temporarily converted into effective obstacles for combat equipment using land mines, some of which are placed beneath the ice on the near bank and the others at the far bank. The charges must be detonated simultaneously, but after the enemy moves onto the reservoir ice. Minefields also can be laid on the ice to restrict the enemy's use of frozen water routes.

Antipersonnel minefields are considered the primary type of antipersonnel obstacles. Various obstacles made of wire fencing and of nets on stakes, knife rests, and hedgehogs also can be used. It is deemed best to replace wooden stakes with metal ones in making wire-fence obstacles (for convenience in driving them into frozen soil). Shaped charges, mechanical drills or heated metal rods are recommended for preparing the stake holes. On wooded terrain the wire usually is attached to trees. Long stakes usually are used so that obstacles can be built up in case of snowfall. It is also recommended that concertina wire and barbed tape be used as obstacles in deep snow, since they can be raised or shifted as snow accumulates.

It is thought best to place antitank and antipersonnel minefields, booby traps, trip flares and other manmade obstacles on exposed flanks and in large gaps between subunits and units. It is recommended that antilanding obstacles be placed in areas where an assault force landing is possible.

It is believed that great emphasis must be placed in the defense on covering artillery firing positions, missile subunit launch positions, and the locations of control posts, communications centers and logistics entities with controllable obstacles and signaling equipment.

Considerable emphasis is placed on laying and camouflaging mines. It is stressed that mines of standard color can be laid the year around in areas overgrown with low brush or on moss-covered tundra. Mines can be placed right in the snow on open terrain in winter, in which case they must be painted white. In places where the snow cover is no more than 10 cm the mine pressure plate must protrude 1-2 cm above the earth's surface. Mines are laid on the surface of the soil in those cases where the snow cover is 10-30 cm thick. When the snow cover is over 30 cm thick mines are fastened to wooden cross pieces or sandbags such that the plates are 15-30 cm beneath the snow surface, or 10-15 cm below the surface in compacted snow.

It is recommended that pressure-operated mines be placed on wooden or other bases on frozen marshy soil, since otherwise they may not function during a thaw. Steps must be taken to protect them against moisture, and pull-action, rod-type, proximity and other fuzes must be used to increase reliability. Preference is given to fuzes of the first two types for use on snow covered terrain. The wire should be stretched at a height of 45 cm from the snow surface.

It is best to lay mixed minefields when mining terrain with remote systems, especially at landing sites and in sectors of operation of enemy airborne assault forces and airmobile troops. Foreign military specialists emphasize that snowfall, blizzards, and the change of seasons can significantly reduce the effectiveness of minefields, and so it is recommended that their condition be constantly monitored, a random check be made of individual mines, and that they be shifted if necessary. It is believed that preparation of such obstacles in northern areas takes more manpower, resources and time than under ordinary conditions.

The most important engineer support missions are water supply, the organization of engineer equipment servicing and repair, supply of construction materials, and so on.

The foreign press notes that on the whole, engineer support to troop combat actions under arctic conditions presents a difficult problem. The outcome of combat will depend largely on how this problem is solved.

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BRITISH ARMY RADIATION AND CHEMICAL RECONNAISSANCE EQUIPMENT

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[Article by Maj I. Yegorov; passages rendered in all capital letters printed in boldface in source]

[Text] The British military-political leadership, which actively supports the militaristic course of the United States and NATO, is devoting considerable attention to training ground forces to conduct combat actions, including when weapons of mass destruction are used. Work is being done at the same time to create and improve reconnaissance equipment and means of protection against such weapons. Radiation and chemical reconnaissance equipment, which has undergone substantial development in this country, is given an important place in the system of such measures.

Standard radiation reconnaissance equipment of the British Army includes roentgenometers, portable dosimeters, and individual direct read-out pocket dosimeters (with battery chargers) and so-called "blind" dosimeters.

The ROENTGENOMETER NO 2 (Fig. 1 [figure not reproduced]), which is supplied to mobile radiation patrols, is designed to measure gamma radiation levels on the terrain within the 0-300 roentgens per hour band. It has three measurement scales (white, blue and red) corresponding to the 0-3, 0-30 and 0-300 roentgents per hour sub-bands. The roentgenometer is powered from two 1.5 volt sources. The lower portion of the instrument case has a removable shielding panel for measuring the dose rate of beta radiation. The roentgenometer is carried in a cloth bag with a polyvinyl chloride cover. Its dimensions are 232x95x149 mm and it weighs around three kilograms.

The LIGHT ROENTGENOMETER is designed to measure the gamma radiation levels on the terrain in the 0-100 roentgens per hour band. The instrument has a semi-cylindrical shape (its dimensions are 146x127x95 mm and it weighs around 1.3 kg) and it is powered from two voltage sources of 10.8 and 1.35 volts. There is a shoulder strap to carry the roentgenometer.

The NIS501 GAMMA AND BETA RADIATION PORTABLE DOSE-RATE METER (Fig. 2 [figure not reproduced]) operates in the 0.1-1,000 roentgens per hour band and has a logarithmic measurement scale. An ionization chamber is used as a sensor. To

measure the beta radiation dose-rate, the sensor is housed in a cylindrical steel case with windows that close. Two mercury batteries (2.7 volts and 1.35 volts) support the device's continuous operation for 100 hours. In the presence of radioactive emissions the instrument gives readings every three seconds after being turned on. The meter is 160x108x54 mm in size and weighs 1.4 kg. It is carried in a special case.

The PDRM82 PORTABLE DOSE-RATE METER (Fig. 3 [figure not reproduced]) is designed to measure radiation levels in the 0-3,000 megaroentgens per hour band. It is installed in a plastic, moisture-proof case. The only control, an on-off knob, is of rather large size, which is important when working in protective gloves. Dose-rate readings light up on a large, four-place digital liquid-crystal display, which also displays all additional information about the device's operation: circuit failure, a voltage drop of the power sources to an amount at which the device will operate no more than ten hours, and a change in the dose-rate beyond the upper limit of the measurement band. The device is 175x135x30 mm in size and weighs 560 g. It operates in the temperature range of from -10° to +45°C. It is powered from three 1.5 volt sources, which allow the device to operate continuously for 400 hours. When used in the fixed version, the meter set includes a remote probe with a 5 m connecting cable.

The British ground forces have INDIVIDUAL DIRECT READ-OUT POCKET DOSIMETERS to monitor the personnel's exposure. Depending on their purpose, they are subdivided into laboratory and troop (tactical) models. The former are manufactured with measurement bands of 0-200 and 0-500 milliroentgens and are used primarily to check the radiation doses when calibrating instruments and in diagnosing radiation injuries of personnel. Troop dosimeters have the following measurement bands: 0-5, 0-50, 1-100, 0-200 and 0-500 roentgens. An ionization chamber in which a microelectroscope with a quartz filament is installed represents the sensing element in each instrument. The filament is repelled from the wire electrode in the dosimeter's charged state, and is drawn to it as the dosimeter discharges (which is caused by ionizing radiation). The amount of absorbed radiation dose is determined from the filament's deflection, viewed through an eyepiece with inscribed graduations. The dosimeter reading error is ±10 percent.

The dosimeters are 116 mm long, 13.8 mm in diameter and weigh 40 g. They are kept in transparent cylindrical plastic cases, and are carried in the vest pocket in a combat situation; there are clamps on their cases for this purpose. A battery charger serves for recharging.

The "blind" dosimeters of the firm of Fisher Controls are designed to measure the cumulative absorbed dose of direct and induced gamma and neutron radiation in the 0-1,000 rad band. They have the shape and dimensions of a wristwatch and are worn on the wrist by servicemen. The dosimeter includes two independent sensing elements--a silver-activated radiophotoluminescent phosphate glass, and a silocon photodiode.

The amount of cumulative dose received is determined by a measuring device (Fig. 4 [figure not reproduced]), and for this the dosimeter is placed in the

recess of its pull-out section. When the device is turned on the dosimeter's phosphate glass is irradiated with ultraviolet light of a xenon tube and the glass begins to fluoresce under the effect of the light. The absorbed dose of gamma radiation is determined according to the degree of luminescence, measured with the silocon photodiode. The amount of a neutron radiation dose is measured from the forward voltage of the silicon photodiode when a current of 100 milliamps is passed through it. The obtained values of gamma and neutron radiation doses are added and the cumulative dose lights up for three seconds on the illuminated display of the measurement device.

The dosimeter weighs 75 g, it is 40 mm in diameter and 12 mm deep. Its measurement error is ±15 percent. The size of the measurement device is 270x210x210 mm and it weighs some ten kilograms. It is powered from a 24-volt storage battery. The foreign press reports that dosimeters are issued to all personnel and are collected by the commander for a check after the enemy employs nuclear weapons or at the end of the subunit's operations under conditions of radioactive contamination.

Detector paper, a gas detector and an automatic gas alarm are among the standard chemical reconnaissance equipment designed to detect toxic agents (OV).

The Mk 2 adhesive detector paper No 2 detects toxic agents employed in a droplet state. The paper is supplied to the troops in the form of booklets of 12 sheets 115x60 mm in size. The adhesive side of the sheet of detector paper is covered with cellophane. The procedure for detecting toxic agents assumes that one or two sheets of paper torn from the booklet are attached with their adhesive side to the outer sections of the surface of clothing, gear and combat equipment, contamination of which presents the greatest danger for servicemen. The paper's usual color is gray-green, and blue spots appear on it when it comes in contact with drops of toxic agents.

The British serviceman's set of individual protective gear also includes a booklet of non-adhesive detector paper which permits identification of such toxic agents as VX, sarin, soman and yperite from a change in coloration.

GAS DETECTOR NO 1 MK 1 (Fig. 5 [figure not reproduced]) is used to detect the vapors and aerosols of nerve gases and yperite in the air, on combat equipment and gear, and in soil samples. The instrument set includes 32 indicator plates; four plastic bottles of reagent, supplied with dropper tubes and screw caps; a rubber bulb with adapter; instructions; and a canvas carrying case.

Toxic agents are detected as follows. The glass ampules with reagent which are contained within the plastic bottle are broken. An indicator plate is removed from the package, then the disc of sorbent on the plate is moistened with the prepared reagent from the plastic bottle, using the dropper tube. After this the indicator plate is inserted in the adapter of the rubber bulb, which is used to pump the air to be analyzed through the sorbent disc. The toxic agent type is determined from the specific disc coloration which appears as a result of a reaction.

The foreign press notes that the indicator plate has a sensitivity of 0.03 mg/m^3 for sarin and 0.04 mg/m^3 for VX. It takes up to ten minutes to perform one complete analysis. The gas detector can be used to perform 20-25 analyses, after which it must be refilled. According to standards for supply of toxic agent detection equipment, each British Army squad has one gas detector No 1 Mk 1.

The NAIAD (Nerve Agent Immobilized Enzyme Alarm and Detector) AUTOMATIC GAS ALARM is designed to detect vapors of nerve gases and prussic acid in the air, followed by a chemical attack warning to subunit personnel.

The principal components of the gas alarm are the detector (Fig. 6 [figure not reproduced]) and remote signal unit (Fig. 7 [figure not reproduced]). The detector's operation is based on the principle of the immobilized enzyme of choline esterase being combined by toxic agents, as a result of which the detector's electronic circuit is triggered and audio and light alarm signals are given. The instrument can operate for 12 hours in the mode of continuous monitoring of the chemical situation. The working range of temperatures is from -31° to +52°C. The detector's dimensions are 251x209x475 mm, and it weighs 12.5 kg with the power source (a nickel-cadmium battery). The minimum concentration of detectable toxic agents is 0.005-0.05 mg/m^3, depending on their type.

Up to three remote signal units placed at a distance of up to 500 m can be connected to the detector using an ordinary twin-core field wire. The remote signal unit serves to give the audio and light alarm signals. It is 232x177x99 mm in size and weighs 2.5 kg. It is powered by a mercury battery.

In the opinion of foreign specialists, the NAIAD device meets modern requirements on the whole. The belief is that it has a rather high sensitivity and is capable of operating under actual combat conditions, including in the presence of heavy vibration and the effects of an electromagnetic pulse. The gas alarm can be used in a portable version and it can be installed on fixed objects and various pieces of mobile equipment (armored personnel carriers and vehicles). It is supplied to the troops on the basis of one device per platoon.

Judging from foreign press materials, Great Britain is continuing further development of more effective means of detecting toxic agents. In particular, the English firm of Graseby Dynamics created a new portable CHEMICAL RECONNAISSANCE DEVICE, the CAM (Chemical Agent Monitor, Fig. 8 [figure not reproduced]). It is designed to detect vapors of nerve gases and yperite and to monitor the completeness of gas decontamination. The device weighs 1.5 kg and is 380 mm long. A 6-volt lithium-thionyl chloride battery serves as the power source. The device is capable of operating in the temperature range of from -30° to +55°C. Its continuous operating time without a battery change is six hours.

The CAM device uses the principle of ion-cluster spectroscopy in which contaminated air is sucked in and ionized using a source of radioactive emission. Ion clusters appear from the ionization of toxic agent vapors; the clusters

have lesser mobility than ions of atmospheric air. Toxic agents are detected with the help of a microprocessor based on the intensity of peaks in mobility spectra.

Signals concerning the device's readiness for operation and condition of the power source, and data on the presence and type of toxic agent in the air are presented on a liquid crystal display screen. There is a provision for giving an audio alarm signal to the operator through earphones connected to the device. There are two switches on the instrument case: one to turn on the device and the other to change the work mode (detection of nerve gas or yperite). The battery is in the instrument's handle.

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PROSPECTS FOR THE DEVELOPMENT OF AERIAL RECONNAISSANCE EQUIPMENT AND TACTICS: VIEWS OF WESTERN MILITARY SPECIALISTS

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 39-44

[Article by Col A. Krasnov, doctor of military sciences, professor; passages rendered in all capital letters printed in boldface in source]

[Text] Military leaders of the aggressive, imperialist NATO bloc are devoting careful attention to the development of aerial reconnaissance. They believe that the increase in troop mobility and in rapidity of combat actions, the opposing sides' mass employment of various types of weapons, and increased capabilities for the surprise employment of weapons contribute to transforming aerial reconnaissance into a decisive factor of strategic importance. In their opinion, aerial reconnaissance is capable of collecting data on the most diverse enemy objectives under any combat conditions and practically regardless of time of day and weather even now, under present-day conditions, thanks to the appearance of the latest reconnaissance aircraft fitted with highly effective photographic, radio, electronic intelligence, infrared, radar and other gear.

Prospects for a further improvement in aerial reconnaissance capabilities are discussed regularly in the foreign press. Based on available statistical data and using simulation, extrapolation, expert assessments and other forecasting methods, western specialists estimate the paths of improvement for the aircraft inventory for tens of years in the future and predict the creation of new models of reconnaissance equipment. They encounter the greatest difficulties, however, in considering the development of aerial reconnaissance tactics. NATO, and above all American military theorists, directly link the question of what aerial reconnaissance will be like in the future with the following basic factors: the change in troop requirements for aerial reconnaissance, the more complex nature of reconnaissance objectives, an increase in the number of objectives, an increase in the might of the air defense system, and prospects for creating aerial reconnaissance equipment. The capabilities of other kinds of reconnaissance which accomplish similar missions also are considered here.

Foreign specialists formulate the TROOP REQUIREMENTS FOR AERIAL RECONNAISSANCE based on the need for reconnaissance information. The extent to which those

needs are satisfied is regarded as the principal criterion of aerial reconnaissance effectiveness. It is emphasized that troop requirements for aerial reconnaissance are dynamic, they exist within a certain framework, and they serve specific objectives. During World War II, for example, they were different than during World War I, they substantially differ from previous requirements today, and they will undergo changes in the future. This is caused by the changes occurring in technical outfitting and in the nature of troop combat actions, and by the ever growing needs for reconnaissance information.

Under the influence of these requirements there has been a sharp increase in the depth and size of the areas where aerial reconnaissance is conducted, the amount of data collected has increased and the time periods for delivery of data have been curtailed, i.e., today commanders and staffs have to know (preferably in real time) what the enemy is doing not only in the tactical depth, but in the operational depth as well; how he is maneuvering; where he is concentrating the main body of troops and aircraft; where he is building defensive lines, and so on. Right at the present time, in connection with the concept of "follow-on-forces attack" adopted by NATO (where the principal condition for achieving success is considered the capable organization of the enemy's engagement in depth primarily through the use of all kinds of new precision weapons), very high demands are being placed on aerial reconnaissance for an expansion in its coverage, for precision in determining target coordinates, for classification of targets, and for continuity of observation and timeliness in transmitting data to command posts.

In forecasting the nature of combat actions, the western military press writes about a further growth in troop firepower, an increase in troop mobility, and the creation of new kinds and generations of weapons capable of engaging enemy troop groupings to the full depth to which their combat formations are alined. It is noted that demands placed on aerial reconnaissance by combined-arms and air commanders will interface with each other in a more and more complex manner in the future.

Aerial reconnaissance will have to provide for a rapid search for targets, an accurate determination of their locations and basic characteristics, and target designation to friendly strike assets. At the same time, the equipment and tactical procedures must allow reconnaissance aircraft crews to conduct continuous surveillance of enemy activities in vast areas and promptly issue generalized data to the higher command element.

In the opinion of foreign specialists, INCREASED COMPLEXITY OF RECONNAISSANCE TARGETS occurs through the creation of new models of military equipment and dispersal of equipment components on the terrain. The number of the most important pieces of equipment will increase, however, because smaller and smaller subunits will be armed with powerful weapons and those subunits will be dispersed within troop combat formations. Independently operating operational-tactical missile subunits, artillery batteries and surface-to-air missile systems also will remain reconnaissance targets in the future. They will be positioned over a large area and will seemingly scatter to all sides.

All this will require surveillance to be organized over a multitude of small, highly mobile targets and more frequent observation of them by reconnaissance aircraft crews. The foreign press indicates that principal reconnaissance efforts will have to be concentrated on identifying weapons and weak or vulnerable spots in the opposing side's defense.

In assessing likely changes in the nature of targets, foreign specialists emphasize the growing effectiveness of their concealment against existing reconnaissance gear. In their opinion, the disparity between aerial reconnaissance capabilities and the effectiveness of camouflage will make itself known with impressive force in just the next few years. The more skillfully targets are camouflaged and the more difficult it is to detect them, the more advanced aerial reconnaissance equipment and tactics must be. Therefore foreign specialists believe that in order to detect targets covered by new means of camouflage it is necessary to develop qualitatively new and highly sensitive surveillance assets which will allow reconnaissance aircraft crews to detect and identify targets from other revealing signs not yet being used by enemy aerial reconnaissance and to employ tactical procedures unknown to him for a more complete realization of the developed equipment's capabilities.

The West regards an INCREASE IN THE MIGHT OF THE AIR DEFENSE SYSTEM as one of the most important criteria determining the development paths of aerial reconnaissance tactics. Even today, foreign specialists are not very confident in placing the equal sign between capabilities of the reconnaissance aircraft and of the enemy air defense system. What will the latter be like in the future? NATO military theorists unanimously forecast a further strengthening of its combat might.

In their forecasts they speak about a transition of the air defense system to fundamentally new methods of detecting airborne targets which differ from traditional methods. In particular, they report the development of over-the-horizon radar in the high frequency band using the principle of wave reflection from the ionosphere. The detection range of aircraft (including those flying at low altitude) can reach 3,000 km or more. The proportion of phased-array radars, which provide a practically instantaneous survey of space and frequency agility, is increasing in the inventory of air defense radars. In the opinion of foreign specialists, it will be extremely difficult to detect the operation of and neutralize such radars, which have a high ECCM capability. There is continuing improvement on other early warning systems and active resources (surface-to-air missile systems, air defense artillery and fighter aviation).

Western experts believe that the enemy also will have the very same systems in the future, and so enormous airborne target kill zones will cover the sky on the approaches to all zones of important objectives. These kill zones will be established by groupings of short, medium and long range surface-to-air missile systems capable of hitting reconnaissance aircraft maneuvering at high g's (up to eight g's). There will be an increase in effective range, rate of fire (up to 120 rounds per minute) and accuracy of antiaircraft tube artillery. Its inventory possibly will include guns with terminal guidance of projectiles and electromagnetic guns permitting use of the electromagnetic

principle of accelerating projectiles to hypersonic velocity and thus assuring a short time of flight to the target (1-2 seconds).

The foreign press has noted in addition that implementation of new engineering solutions in the aerodynamic configuration of aircraft and in controlling the thrust vector of their engines will allow having future fast, highly maneuverable air defense fighters with different aerodynamic and design configurations, power plants and weapon systems. Armed with all-aspect missiles having ramjet, jet and combination engines, these fighters will be able to carry out an undetected, automated intercept of reconnaissance aircraft flying much higher or lower, including at extremely low altitudes.

Based on all the above, it is the opinion of NATO military experts that the best solution would be to create those reconnaissance aircraft which could perform stand-off reconnaissance, i.e., without entering enemy air defense coverage. Certain steps are being taken in this direction even now in the U.S. Air Force and air forces of other bloc members. In particular, the E-3A airborne warning and control aircraft (the AWACS system), high-altitude TR-1 reconnaissance aircraft (Fig. 1 [figure not reproduced]) and other aircraft fitted with appropriate equipment are being widely used to observe enemy territory without violating his borders. A need arises to use reconnaissance aircraft which penetrate enemy air space, however, because of the limited capability of the stand-off aircraft and the need to obtain more accurate and valid data about reconnaissance targets, and especially for final reconnaissance of targets. The western press notes, therefore, that aircraft of both the above categories will be in the order of battle of military aviation of NATO countries in the very near future.

Narrower forecasts which define the development of AERIAL RECONNAISSANCE EQUIPMENT lie behind these general forecasts. Above all this concerns the appearance of reconnaissance aircraft. Prospects for their development generate foreign military theorists' pictures which grip the imagination.

The efforts of foreign aircraft designers are directed toward exploring technical capabilities for achieving concealment of reconnaissance aircraft operations. Their designs make ever increasing use of materials which absorb and weaken radar signals or which change the direction of reflected signals, and devices for reducing infrared emissions. The latter devices are used to lower engine exhaust temperature (for example, by introducing additional air flows) and to shield radiation zones. There is a clear-cut trend toward achieving concealment in reconnaissance aircraft operation through design features of the aircraft. For example, American specialists are working to create aircraft difficult to detect by ground-based air defense weapons (the Stealth program). In particular, an aerodynamic shape is being developed in which design components are rounded and the fuselage is joined smoothly with the wing so as to reduce radar cross-section even more.

Considering the experience of combat employment of the American SR-71 supersonic high-altitude reconnaissance aircraft (Fig. 2 [figure not reproduced]), U.S. Air Force experts believe that hypersonic reconnaissance aircraft can be created in the future which will be able to fly at a speed of Mach 4-8 at

altitudes of 30-75 km. In their opinion, such aircraft will successfully penetrate enemy air defense and quickly reach the reconnaissance targets. Combination engines capable of operating in a turbojet mode (at low speed and low altitude) and a ramjet mode (at high speed and high altitude) are to be installed in them for flying in such broad altitude and speed ranges. These engines will be able to use both conventional hydrocarbon fuels as well as liquid fuels--methane or hydrogen. In the estimates of western experts, such aircraft may be created by the beginning of the 21st century.

Considering the appearance of the most numerous reconnaissance aircraft, however, foreign military specialists note that such aircraft were created previously chiefly by modernizing certain combat aircraft for accomplishing reconnaissance missions. In particular, the RF-4 reconnaissance aircraft, which is in the inventory of air forces of the United States, the FRG, Turkey and many other capitalist states to this day, was created on the basis of the widespread American F-4 Phantom-2 multirole tactical fighter. The same also can be said about the F-104 and F-5A fighter-bombers and other warplanes (RF-104, RF-5A and so on). Relying on this thesis, western experts believe that the overwhelming majority of reconnaissance aircraft (especially tactical reconnaissance aircraft) will be created in the future on the basis of the combat aircraft of that time and consequently the performance characteristics of both will be similar (Fig. 3 [figure not reproduced]).

In the more distant future the United States is planning to create aerospace reconnaissance aircraft--winged craft with liquid-propellant rocket engines. These aircraft are to be sent up to a certain altitude with the help of spacecraft or heavy transport aircraft, and from there they will be launched into near-earth space. Such a flying craft will enter the denser layers of the atmosphere to carry out the mission, and then will fly and land like a conventional aircraft.

In considering possible directions for the development of reconnaissance equipment, western experts emphasize that it is such equipment, which contains elements of scientific-technical novelty, that holds very promising prospects for aerial reconnaissance tactics. Military theorists and designers dream of general-purpose, all-weather equipment which allows obtaining exhaustive information about targets in poor visibility without an immediate approach to them, and "observing" a target through a screen of natural and manmade camouflage. This concerns integrated, multipurpose equipment which picks up target emissions in a broad range of the electromagnetic wave spectrum.

The foreign press has reported further improvement in traditional kinds of reconnaissance equipment and an exploration of new revealing signs.

For example, there is an investigation being made of the possibilities of detecting targets from their radial emission of thermal origin. It seems possible to identify targets which the enemy has concealed from photographic, infrared and radar equipment and determine their internal structure and coordinates based on the characteristics of these emissions (intensity, spectral composition, degree of polarization). It is emphasized that the enemy won't be saved by antiradar coatings, since they themselves are good emitters

of a certain spectrum. Camouflage nets and smoke screens also will be unable to hamper the registration of target emissions. In addition, microwave equipment will permit crews to detect preparation for take-off by aircraft at airfields, and the aircraft taking off, from the operation of their engines, carry out a search for sea targets, including submarines, based on their wake, and so on. This equipment also can be used for weather reconnaissance and for detecting storm fronts, zones of increased atmospheric turbulence and other phenomena dangerous for aircraft flight. In the opinion of foreign scientists, the combination of such features of non-emitting equipment as the possibility of performing reconnaissance undetected and operating in any weather permits regarding it as very promising.

Foreign specialists note that the use of new models of reconnaissance aircraft fitted with equipment based on various physical principles of detecting targets will be reflected in specific requirements placed on aircraft maneuvering, precision in maintaining flight regimes, selection of optimum conditions for mission accomplishment, and the possibility of undetected, surprise actions. For example, high altitude will be required to collect electronic intelligence, but such an altitude will not always allow photographic targets in the necessary scale. Flight parameters must be maintained more precisely when using cameras, and especially side-looking radars, than when collecting electronic intelligence. There are many other nuances which aerial reconnaissance personnel will have to take into account when they have integrated equipment aboard.

As foreign aviation specialists emphasize, however, reconnaissance from "super-high-speed" aircraft will require a high degree of crew training (the level of which will border on the limits of man's abilities) and moral and mental readjustments regardless of the type of equipment used. In addition, changes in many directions in the development of tactics are inevitable. Therefore there will be numerous studies, calculations and refinements of existing hypotheses and the development of new ones. It is noted that although the present time has not yet generated a single satisfactory hypothesis, it is an already unquestioned fact that the performance of missions under conditions of an ever-increasing enemy air defense opposition will remain, for aerial reconnaissance tactics, that important problem through which all other factors affecting its development will be considered.

The future air defense system engenders special alarm in some military theorists. Drawing a depressing picture of its growing might, they assume that it will tightly close the sky to aerial reconnaissance. Others believe that there is no cause for despair. They remind us that the very same forecasts were advanced in the late 1950's, when a major qualitative leap occurred in air defense with the appearance of surface-to-air guided missiles and all-weather interceptors. In their opinion, however, past experience irrefutably proves that reconnaissance personnel always have had both technical innovations and new tactical procedures for penetrating air defenses in response to each critical situation.

For example, in forecasting the tactics of the crews of the so-called "invisible aircraft" (the Stealth program) based on undetected and surprise actions,

American specialists declare that if more advanced air defense radars are developed in time which allow "seeing" the reconnaissance aircraft again, then to achieve secrecy the latter will have to lay out the flight path to bypass such radars and explore some other tactical procedure. Based even on this one example, they conclude that aerial reconnaissance personnel will have to strive for concealment and surprise and explore ways for complete use of tactical features of aircraft and equipment in the most distant future as well.

In forecasting aerial reconnaissance tactics, foreign experts attempt to clarify its future against the background of a rapid development of other types of reconnaissance and to clarify the range of missions it is to accomplish in connection with this. They thoroughly analyze the capabilities and the strong and weak points of each type of reconnaissance, but they place greatest emphasis on space reconnaissance, regarding it as the principal competitor of aerial reconnaissance.

The foreign press already reported long ago that by using space equipment it was possible to systematically observe enormous territories in the shortest possible time periods and collect valuable information on a considerable number of the most distant and important targets. Equipment installed aboard reconnaissance satellites is very effective for collecting information about tests of new weapon systems and for detecting missile launchers, aircraft at airfields, air defense weapons, headquarters, command posts and small targets. Space reconnaissance data can be transmitted quickly over television and radio channels or can be dropped in special containers.

The great capabilities of space reconnaissance were immediately highly appraised abroad, and some military specialists concluded that the days of aerial reconnaissance were numbered. Discarding the advertising and propaganda fabrications regarding the superiority of space reconnaissance over all other sources, however, western experts assert the converse: although reconnaissance from space permits collecting data not accessible to aerial reconnaissance, it is incapable of replacing aerial reconnaissance. They note the following weak points of space reconnaissance: the long time needed to place reconnaissance satellites in a certain area, which may require not one but several passes; the impossibility of detecting targets camouflaged against space observation; high cost of reconnaissance systems; and the absence of continuous surveillance of one and the same mobile targets. In addition, they believe that space reconnaissance equipment can be jammed.

With respect to aerial reconnaissance, foreign specialists believe that the capability of conducting continuous surveillance of the enemy in the tactical and operational depth and its high validity and activeness make it irreplaceable both at the tactical and operational levels. Therefore aerial and space reconnaissance must supplement each other.

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FRG AIR FORCE MOBILIZATION EXERCISES

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 45-46

[Article by Lt Col V. Sergeyev]

[Text] According to the western press, a further activation of measures being taken by the Bundeswehr command to prepare for an aggressive war against the USSR and other countries of the socialist community is being seen in the FRG. Much emphasis is being placed of late on timely preparation of a trained military reserve for all branches of the armed forces, intended in the event mobilization is declared for bringing regular units and subunits up to strength, for expanding cadre [kadrirovannyy] units and subunits and activating new ones and for replacing losses during combat actions.

Such measures are assuming ever-increasing scope in the West German Air Force as well. The foreign press reports that plans for the mobilization deployment of the FRG's armed forces provide for calling up to 100,000 reservists into the Air Force (approximately half of the proposed wartime strength of the Air Force). Of these, 45,000 persons are earmarked for bringing regular units and subunits up to strength and 55,000 are for manning cadre units and subunits and activating new ones (which primarily perform missions of security and defense of various installations, repair and restoration work, supply and so on).

According to foreign press data, there are almost 400,000 trained reservists registered with the FRG Air Force at the present time. They are retrained by setting up short courses and mobilization exercises. As is apparent from an interview with Lt Gen (Eimler), Inspector of the Bundeswehr Air Force, by a correspondent of the West German journal WEHRTECHNIK (November 1984), the FRG Air Force has implemented a system for filling out large and small units [soyedineniye and chast] in case of mobilization and during combat actions, as well as new provisions for conducting mobilization exercises.

Foreign military specialists emphasize that all these measures are taken to familiarize reservists in advance with the nature, scope and conditions of their performance of functional duties in wartime and thus to improve the Air Force's combat capabilities to accomplish the combat missions assigned to it.

The following are data based on foreign press materials concerning certain mobilization exercises conducted in the Bundeswehr Air Force units and subunits in the fall of 1984.

The largest was an exercise by the 33d Fighter-Bomber Squadron (F-104G aircraft, Buechel Air Base) under the codename Eifelschild-84. Its purpose was to test plans for reinforcement and support of uninterrupted activities of the squadron during combat actions. The following missions were practiced in the exercise: notification and assembly of reservists; bringing cadre subunits up to strength of wartime tables of organization; organization of security and air defense of the Buechel Airfield and of other squadron installations; and the personnel's mastery of organic weapons and equipment.

This exercise lasted 14 days, with the participation of squadron headquarters and all subunits, airfield maintenance battalion, the Air Force's 2d Training Regiment and the 233d AAA Battery. A large number of reservists (officers, NCO's and privates from 30 to 45 years of age) were called up and were used primarily to man the cadre 233d AAA Battery, the cadre 24th AAA Battery of the 2d Air Training Regiment, the cadre 33d Security Squadron and a number of other logistics subunits. As a rule, the reservists called up were those assigned to the aforementioned subunits and living on the territory of the Lands of the Rhineland-Pfalz and Saarland within a radius of up to 150 km from the squadron's base location. As exercise experience showed, however, a significant number of reservists who received notification to arrive in their subunits were released from the call-up at their personal request (chiefly because of being busy at work and out of fear of losing a job, which is warranted by the present strained employment situation in connection with high unemployment in the FRG). The district draft points were forced to send other reservists in their place, many of whom had an insufficient training level, in the opinion of the squadron command. Some of them, especially older people, did not stand the considerable physical loads under the cool and rainy weather conditions which set in during the exercise.

There was a two-week exercise by the cadre 9th AAA Battery, 5th Air Training Regiment in approximately this same period (it has 20-mm twin antiaircraft mounts, see figure [figure not reproduced]). The exercise objective was to test the plan for battery deployment in case of mobilization and to train the personnel, primarily the reservists, to master organic weapons and equipment and the techniques and methods of repelling enemy air raids against fixed objectives. The following missions were practiced during the exercise: notification and assembly of reservists; receipt of equipment and weapons from warehouses and demothballing; execution of a march of up to 150 km; organization of installation air defense; and field firings against airborne targets under various conditions (at a practice range).

In an exercise involving the 6th Regiment of the FRG Air Force Logistics Command (Oldenburg) there was practice in bringing its motor transport subunits, including the cadre 62d Motor Transport Company, up to strength in personnel and trucks. It was brought up to strength in vehicles at the expense of private owners and firms of the Oldenburg and Ems districts. Some 100 vehicles with a load capacity of from 2 to 36 tons were mobilized. The regiment's specialists checked the technical condition of the vehicles and the presence of

tarpaulins, loading and unloading devices, spare parts, tools and so on for three days.

As the foreign press reports, the Bundeswehr Air Force command drew appropriate conclusions from results of these exercises and outlined ways to remedy the deficiencies which were identified. Special emphasis was placed on the need for a more careful selection by draft points of persons for holding positions in the cadre subunits requiring high professional training, such as antiaircraft gun commanders, air lookouts and others.

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USE OF THE EXTREMELY HIGH FREQUENCY BAND IN AIRBORNE ELECTRONIC SYSTEMS

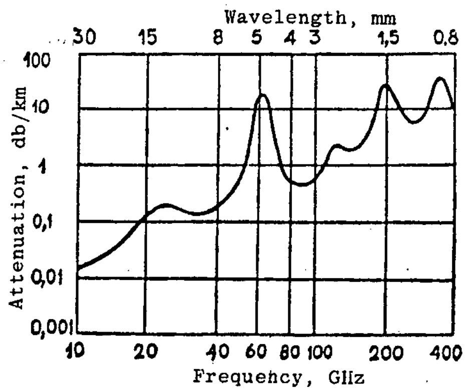
Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 46-52

[Article by Maj A. Bokov; passages rendered in all capital letters printed in boldface in source]

[Text] In building up military preparations, the aggressive imperialist circles of the United States and other NATO bloc member countries are placing special emphasis on improving electronic systems of various types. Foreign specialists consider the development of new, higher frequency bands to be one of the most stable trends in the development of military electronics. This is explained by several permanently operating factors. Above all there is the increase in the number of electronic resources being used in conducting combat actions, which causes an overload of already developed bands. In addition, electromagnetic oscillations with varying wavelengths have varying and often mutually supplementary properties. This allows expanding the capabilities of electronic systems by using radio waves of different bands. And finally, in the opinion of foreign experts, the operation of electronic systems in a wide area of the electromagnetic spectrum complicates the enemy's electronic warfare.

The meter and centimeter wave bands were developed abroad in succession following World War II, and the late 1970's and the 1980's are characterized by the wide unfolding of research and development aimed at creating electronic systems in the millimeter band (this band includes electromagnetic oscillations with a wavelength of 10-1 mm, corresponding to the frequencies of 30-300 GHz).

The millimeter band, which takes in the frequency range equal to 270 GHz, is not uniform from the standpoint of the conditions for propagation of electromagnetic waves. For example, with an increase in frequency the attenuation in the band increases approximately on a linear basis, but there are three regions corresponding to the resonance frequencies of oxygen and of water vapors where absorption increases sharply (see figure). Regions of the millimeter band with minimum attenuation, called radio windows, are used most often for the operation of radiotechnical equipment, but a number of systems, designed in particular to operate at short range, also use regions of the spectrum with high absorption. Table 1 gives the limits of sub-bands



Attenuation of millimeter band radio waves in the atmosphere

Table 1 - Millimeter Band Radio Windows and Absorption regions

Sub-bands	Radio Window		Absorption Region	
	Central Frequency, GHz	Central Wavelength, mm	Central Frequency, GHz	Central Wavelength, mm
30—51,4	35	8,6		
51,4—66			60	5
66—105	94	3,2		
105—134			120	2,5
134—170	140	2,1		
170—190			180	1,7
190—275	230	1,3		

allocated by the World Administrative Radio Conference for the operation of radiotechnical equipment, as well as the central frequencies (wavelengths) by which these sub-bands sometimes are denoted. The millimeter waves occupy an intermediate place on the overall scale of the electromagnetic spectrum between centimeter waves (the superhigh frequency [SHF] band) and the very far IR area. This position largely determines both the properties of millimeter waves and the characteristics of electronic systems in this band.

The foreign military press notes the following advantages of millimeter band [EHF] systems in comparison with SHF systems:

--The opportunity of creating antennas with narrow radiation patterns. It has been calculated, for example, that with an antenna diameter of 0.12 m the width of its radiation pattern at half power at a frequency of 94 GHz is 1.8°, while at a frequency of 10 GHz it is 18°. This makes it possible to increase the precision and security of the systems' operations and hampers their jamming.

--Broad bands of working frequencies being used: in four windows of the millimeter band of 35, 94, 140 and 230 GHz the corresponding bands are 16, 23, 26 and 70 GHz, i.e., any of the windows is larger than the entire SHF band presently being used. This provides for a reduction in mutual interference from friendly equipment and complicates the enemy's task of arranging electronic countermeasures. It is believed additionally that an opportunity to increase range resolution appears in active systems, and the opportunity to increase sensitivity appears in passive systems.

Meanwhile, it is noted that EHF radar systems are significantly inferior to SHF systems in operating range because of the considerable attenuation of radio waves in the atmosphere.

It is believed that EHF systems are less subject to the influence of weather conditions in comparison with electro-optical equipment. They operate satisfactorily in fog and with cloud cover, and only precipitation in the form of rain substantially reduces their operating range. For example, in dense fog (with visibility of 100 m) attenuation in the IR and visible optical bands increases to 100 db/km or more, while the attenuation of millimeter waves is not over several decibels per kilometer. In the opinion of foreign specialists, EHF systems will have advantages over electro-optical systems under real combat conditions. For example, the FRG conducted comparative tests of target detection characteristics with EHF systems (94 GHz) and electro-optical systems under conditions of shellbursts along the target's line of sight. Results of the experiments showed the insignificant effect of weapons on the propagation of millimeter waves: signal attenuation was 15 db for 0.9 seconds after the shellburst, and then the target was again detected despite dust and smoke. In this instance the electro-optical systems were disabled for over 20 seconds. The resolution of EHF systems, however, is below that of electro-optical systems.

In giving a general assessment of the millimeter band, western experts note that this region of the electromagnetic spectrum is a compromise area, as it were. Electronic systems can be created here having high accuracy near that of electro-optical equipment, and at the same time providing all-weather capability and around-the-clock use, typical of equipment in the SHF band.

The interest in systems of the EHF band appeared back in the early 1940's, but the first series-produced element-base components were made almost 30 years later. Foreign specialists believe the reasons for this delay to be the insufficient study of conditions for the propagation of millimeter waves and the difficulty of developing a reliable element base. While the first of these reasons has been practically eliminated at the present time, resolution of the second problem will require many more efforts. It is believed that the greatest difficulties lie in creating powerful generator devices. The foreign press reported development of Gunn diodes and magnetrons operating at frequencies up to 100 GHz, and about klystrons and IMPATT diodes (an avalanche-transit diode in the transit mode) which can be used at frequencies of 200 and 300 GHz respectively. The power levels and efficiencies achieved by these devices, however, do not yet satisfy developers of EHF systems.

Necessary system output usually is achieved by adding the outputs of several generator devices. For example, there was a report about the development of a transmitter with IMPATT diodes in the 95 GHz band which provides an output of 40 watts in a pulse mode when the outputs of four diodes are added. Over the next few years it is planned to increase the outputs of generators and power adders by 3 db and 10 db respectively. One of the latest trends is a shift from the use of microstrip elements to monolithic integrated circuits. The existing receivers cover broad instantaneous pass bands, such as from 26.5 to 40 GHz and from 75 to 110 GHz. Judging from western press reports, primary efforts presently are directed at creating systems operating in the 26-40 GHz band.

These advantages and deficiencies of millimeter waves were deciding factors in determining the areas of application of EHF electronic equipment. Radar, navigation, weapon control, communications and EW systems are regarded as the principal areas of application of EHF systems in the avionics of the United States and other NATO countries.

AIRBORNE RADAR AND NAVIGATION SYSTEMS. They include in particular the WX-50 radar of the American firm of Westinghouse, which has undergone flight tests aboard the TA-4J and OV-10 aircraft and the UH-1N helicopter. The possibility of its installation aboard the A-10 attack aircraft (see color insert [color insert not reproduced]) is being studied. The WX-50 noncoherent 8-mm radar provides for operation in the following modes: terrain avoidance and nap-of-the-earth flight; detection and selection of moving ground targets; ground mapping; measurement of flight altitude; and direction-finding of sources of emission (the principal characteristics of this and other radars are given in Table 2).

Table 2 - Principal Characteristics of EHF Radars

	WX-50	AN/APQ-137	Saiga	Drone radar
Frequency, GHz	35	34.5	35	95
Peak power, kw	100	25	7	2
Pulse length, nanoseconds	200	250	200	20
Prf, kHz	2	4	.	5
Width, antenna radiation pattern, degrees	1.5	.	1.3	0.43
Weight, kg	64	.	53	.
Volume, m^3	0.07	.	.	.

In the terrain avoidance and nap-of-the-earth flight mode the radar sends to a display the contour lines of the relief section located up to 5 km ahead of the aircraft, which gives the pilot an opportunity to fly the plane at a height of around 60 m. The scanning sector is 12° in azimuth in the terrain avoidance mode. The radar provides an indication of ground targets moving at a speed of at least 5 km/hr. Enemy helicopters and tanks can be detected at distances up to 16 km.

In the mode for direction-finding of emitting sources the radar can detect and determine coordinates of high-priority emitting targets and issue data on their azimuth to the weapon control system because of the broad band of the antenna reflector. In the mapping mode the radar display shows terrain sectors at distances of 9, 18, 27 or 50 km ahead of the aircraft. The scanning sector is 70° in azimuth for mapping.

The radar is equipped with a scanning cassegrain antenna with a diameter of 0.38 m. The scan rate is 60 degrees per second. The radar can be installed in the aircraft nose or in a belly pod; in the latter case its weight is approximately 132 kg. The WX-50 has a modular design, it is made in the form of six interchangeable units, and it is equipped with a built-in functional check system. The mean time between failures is 300 hours. The moving ground target indication mode is supported by an additional processor.

The foreign press notes that flight tests of the radar aboard the A-10 attack aircraft revealed a number of its deficiencies. In particular, the moving target indication was ineffective. In addition, during operation in the nap-of-the-earth flight mode the need arose to increase the fields of view in

azimuth and elevation, and when flying over a surface with poor radar reflection the radar has to operate only together with the radio altimeter.

The experimental AN/APQ-137 radar of the firm of Emerson Electric is a pulse-doppler radar designed to detect ground targets. It has a 40° field of view in the search mode. The radar provides an indication of targets moving at a speed of 3-30 km/hr. Information is displayed on a screen 130 mm in diameter.

The Saiga radar was developed by the French firm of Electronique Marcel Dassault for installation in helicopters for terrain avoidance and nap-of-the-earth flight under adverse weather conditions and at night. The radar has a ±80° field of view in azimuth in the forward and rear hemispheres and ±10° in elevation relative to the velocity vector. Its operating range is 5 km and it has a range resolution of 30 m. According to foreign press reports, flight tests have shown that the radar detects obstacles such as trees at a distance of 3 km and high-voltage lines at a distance of up to 1.5 km.

The AN/APQ-122 radar was developed by Texas Instruments on order from the U.S. Air Force and designed for installation in military transport aircraft to support airborne delivery under adverse weather conditions. In its dual-frequency modification the radar functions in the 8-10 and 35 GHz bands. The radar provides the following distances when operating in the centimeter band: 370 km for mapping, 277 km for obtaining weather information, and 445 km in the beacon mode. The millimeter band is used when the radar operates at short ranges for determining ground target coordinates and for high-resolution display of a radar terrain map for identifying reference points and for aerial delivery. It is reported in particular that the radar can detect targets with a radar cross-section of 50 m^2 in a rain with an intensity of 4 mm/hr.

The AN/APQ-122 dual-frequency radar presently is being installed in some C-130, RC-135 and KC-135 aircraft.

The British P391 side-looking radar operates in the 8-mm band and is made in a pod version. Two antennas each are used for reception and transmission, with each antenna consisting of 12 vertical waveguides. There is an alternate switching of the right and left antennas with a frequency of 237.5 Hz to obtain images on both sides of the aircraft. The radar data is recorded on 127-mm film.

The Diana radar is being developed by the West German firm of Siemens; it provides for navigation and ground mapping and operates at a frequency of 35 GHz. A magnetron is used in the transmitter's output stage. The radar's waveguide-slot antenna includes three waveguides situated one above the other: the central waveguide is used as the transmitter antenna and the upper and lower waveguides as the receiver antenna. The width of the antenna radiation pattern is 0.7° and 70° in azimuth and elevation respectively, and scanning in the horizontal plane is in a ±30° sector. In the mapping mode, coordinates of ground points are determined based on an analysis of doppler shifts of the radar frequency. There is a display of the surface being mapped on a color indicator, with ground sectors located up to 1,000 m from the aircraft displayed in green, those 1,000-4,000 m away in yellow and those 4,000 m or more away in blue.

The TALONS (Tactical Avionics for Low-Level Navigation and Strike) radar developed by the American firm of Norden Systems is designed for the navigation of flying craft and delivery of low-altitude attacks against ground targets. The foreign press notes that TALONS is the first NATO radar in the 3-mm band which has undergone flight testing. During the tests it was planned to evaluate the radar's operation in the modes of ground mapping, terrain avoidance, terrain following, and on-board weapon control under adverse weather conditions, as well as in the presence of centers of fire and smoke on the battlefield. During the tests the radar was placed aboard a T-39 aircraft in a belly pod, with the radar processor, control and indicator panel, as well as signal processor for evaluating radar characteristics installed in the cockpit.

A drone (BPLA) radar is proposed for use for battlefield reconnaissance and target designation. It has a ±20° field of view, a 50 degrees per second scan rate, and a tank detection range of 3 km in clear weather in 2 km in rain with an intensity of 4 mm/hr.

CONTROLLABLE WEAPON GUIDANCE SYSTEMS. Judging from foreign press reports, such advantages of electronic systems in the millimeter band as small size of input circuits and the possibility of use in adverse weather conditions are especially attractive to developers of airborne guided weapons. Information on selected systems of this type is given below.

Table 3 - Radiometer Characteristics

Characteristic	8-mm Radiometer	3-mm Radiometer
Central frequency, GHz...	35	94
Dimensions less input circuits & power units, mm	29×76×112	100×95×115
Weight, kg.....	0,27	0,74
HF amplifier band, MHz.....	1200	•
IF amplifier band, MHz.....	600	730
Band at filter output, kHz	150	150
Noise ratio, db	7,0	12,5
Temperature sensitivity, degrees.......	1,5	3,5
Measurement time, seconds	4,0—0,4	•
Warm-up & stabilization time, sec	60	•
Rated input, watts..	6,6	•
Operating temperature range, °C	−25 — +55	+5—+30

It is planned to install the RAC (Radiometric Area Correlation) system in American cruise missiles. It will permit more accurate guidance in the middle and terminal legs of the route and when flying over level terrain in comparison with the Tercom system. As with the Tercom, the RAC system uses optimalizing-correlation principles of control. The difference in these systems is that the RAC uses the Earth's levels of natural microwave emission as an information parameter and a highly sensitive receiver-radiometer as a field sensor. According to western press reports, Sperry has developed two radiometers under U.S. Air Force contract which can be used in the RAC system (their basic characteristics are given in Table 3). The first radiometer, which operates at a frequency of 35 GHz, uses microstrip elements and the second is made with semiconductor devices.

The Wasp missile guidance system. A large number of construction principles and approaches to the design of air-to-surface missile guidance systems were studied and experimentally checked in creating the system. The principal task was to develop a homing

head allowing the possibility of target lock-on on the flight path without additional target designation. Such leading American firms as Hughes, Boeing, Rockwell and Honeywell took part in this work on a competitive basis, with their efforts concentrated on creating a millimeter-band radar homing head.

The U.S. Air Force command chose the Hughes homing head, operating in the 3-mm band, based on results of competition. It is believed that an increase in signal attenuation in the atmosphere in the 3-mm band compared with the 8-mm band is compensated by an increase in antenna gain. At the same time, a solution to the problem of detecting the target signal against the background of reflections from the underlying surface is facilitated because of the higher spatial resolution in the 3-mm band. The Hughes homing head transmitter uses an IMPATT diode, with a Gunn diode in the heterodyne. The homing head has a cassegrain antenna with conical scan.

The homing head functions in two modes: active and passive. In the active mode it operates as a conventional pulse-doppler radar. Search and target detection are accomplished at ranges of 3-5 km depending on weather conditions. In the terminal guidance leg, when distance to the target is 300-500 m, the homing head shifts to the passive mode and operates on the target's natural emissions. It is reported in particular that the shift to a passive mode was necessary to increase guidance accuracy. When the missile approaches the target, the mirror reflection from so-called "glitter points" causes amplitude and angular fluctuations in the guidance system which may lead to an increase in error. The use of a passive broadband receiver makes it possible to reduce the influence of this effect.

The majority of guidance systems under development use 8-mm and 3-mm band homing heads (their basic characteristics are given in Table 4). Meanwhile, foreign specialists do not preclude the possibility of creating short-range weapon guidance systems in the 5-mm band. In their opinion, the heavy attenuation of radio waves in this band will make it difficult for the enemy to perform electronic intelligence operations and jam 5-mm band resources. There were reports, for example, of the development of a 5-mm homing head with a Gunn diode for artillery guided projectiles allowing the detection of a small ground target at a distance of 300 m. On the whole, judging from foreign press reports, American firms' experience in creating millimeter-band radar homing heads showed the possibility of developing homing heads weighing 4.5-6.5 kg which are 30-40 cm long and have a diameter of 10-18 cm.

RADIO COMMUNICATIONS SYSTEMS. The Pentagon places constant emphasis on improving satellite communications systems inasmuch as up to 70 percent of the traffic over long-range military communications is transmitted over satellite channels. American experts believe that existing satellite communication lines have insufficient ECCM capability and are subject to the effects of nuclear bursts. In their opinion, the introduction of millimeter-band communication lines is one of the directions for improving the effectiveness of operations.

The United States has been conducting experiments in this direction since the latter half of the 1960's. For example, conditions for propagation of radio waves in the 8-mm band were studied using the ATS-5 satellite. The ATS-6, the first satellite with millimeter-band receiver-transmitter equipment, was

Table 4 - Characteristics of Millimeter-Band Homing Heads

Characteristic	8-mm Band Homing Head	3-mm Band Homing Head
Central frequency, GHz	36	95
Mode	Active-passive	Active-passive
HF amplifier band, GHz	2.0	1.0
IF amplifier band, MHz	900	800
Peak power, watts	7.5	10
Pulse length, nanoseconds	60	50
Pulse repetition frequency, kHz	72	78
Antenna diameter, mm	200	150
Width of antenna radiation pattern, degrees	3.0	1.5
Antenna amplification, db	34.5	39.5
Side lobe level, db	−17	−17
Conical scan frequency, Hz	100	200
Angle of deflection of beam from antenna axis, deg.	1.5	0.25
Range gate length, nanoseconds	60	50
Scan rate, degrees/second	60	150
Field of view in azimuth, degrees	±30	±20

launched in the United States in May 1974. Tests to establish contact with aircraft and ships at frequencies of 20 and 30 GHz were conducted for two years. The work of creating a satellite communications system in the millimeter band later were continued using the LES-8 and LES-9 satellites, which were placed in circular synchronous orbits in March 1976. Equipment was installed aboard the satellites in the decimeter (225-400 MHz) and millimeter (36.6-38.1 GHz) bands.*

The U.S. military leadership links a new phase in the development of satellite communications systems with the appearance of the Milstar (Military Strategic Tactical and Relay) system. Its development is considered a cornerstone in plans of the present American administration to modernize the armed forces command and control system. For example, a memorandum from President Reagan to the Pentagon in March 1984 termed creation of the Milstar system "a program with the highest national priority." It is designed to provide communications for 4,000 subscribers at the strategic and tactical control levels. It is planned to install system sets aboard aircraft, ships, submarines, and fixed and mobile ground-based facilities. It is planned to deploy the Milstar system in the 1980's and early 1990's.

U.S. military specialists believe that Milstar will provide higher ECCM capability and survivability than existing satellite communications systems. It is noted in particular that use of the millimeter band in the Milstar system will permit shortening its time for returning to normal operation following high-altitude nuclear bursts.

The Milstar system will include seven operating satellites and one reserve satellite. Four satellites are to be in a geostationary orbit over the Indian Ocean, the Eastern and Western Pacific and the Atlantic Ocean. It is planned to maintain communications for facilities located in high geographic latitudes via three satellites placed in highly elliptical polar orbits.

It is planned to communicate in the system in two bands: millimeter and centimeter. The earth-satellite channel will operate at a frequency of 44 GHz and the satellite-earth channel at 20 GHz. Each satellite will have 50 millimeter and four decimeter channels for relaying data and telephone messages at rates

*For more detail about experiments with the LES-8 and LES-9 satellites see ZARUBEZHNOYE VOYENNOYE OBOZRENIYE, No 3, 1985 pp 18-20--Ed.

of 2.4 kilobits per second and 75 bits per second. To increase the ECCM capability it is planned to use broadband signals and pseudorandom retuning of the carrier frequency within 2 GHz limits. It is planned to use a multiple-beam phased antenna array as the satellite antenna. The belief is that it will allow an automatic change in the radiation pattern's position in space if enemy jamming is detected so that its minimums are directed toward the source of jamming. In the opinion of American military specialists, it will take a one megawatt gyrotron generator with an antenna of some 10 m in diameter to jam satellite channels in which such ECCM measures are taken. Autonomous on-board systems for orientation and maneuvering in orbit are to provide for the satellite's planned ten-year service life. Launch of the first satellite of the Milstar system is planned for 1988. The U.S. Air Force command proposes to use the Milstar system to provide communications for strategic bombers, airborne command posts, tanker aircraft and AWACS aircraft both among themselves and with ground and shipboard command posts.

ELECTRONIC WARFARE SYSTEMS. The foreign press notes that the creation of military electronic systems operating in new bands inevitably leads to the development of electronic countermeasures [ECM] equipment for the corresponding frequencies. It is believed that features of millimeter band systems are causing the appearance of a multitude of new problems for the developers of ECM equipment and at the same time make it easier to create means and methods for radar ECCM. These features include narrow antenna radiation patterns, a broad working frequency selection band, and the possibility of using broadband pseudorandom signals. Millimeter wave antennas have a higher ratio of the main lobe of the radiation pattern to the side lobe than SHF antennas, and so jamming the side lobes is more complicated. The jamming of missile homing heads operating in a passive mode also presents a serious problem.

Many ECM systems are designed purely for energy suppression, but powerful millimeter wave generators have a low efficiency, which complicates the cooling system. Although gyrotrons have a rather high efficiency, they are large. The high-power millimeter wave generators usually are short-lived and require a voltage on the order of 20-100 kilovolts. The western press reports that the United States presently has created a traveling wave tube for an 8-mm band ECM system with around 10 watts of output in a continuous mode.

ECM systems of modular design being developed in the United States provide for the possibility of building up units to allow for jamming in new frequency bands. For example, the AN/ALQ-165 ECM system designed for installation in the F-14, F-18, EA-6B, A-8B, F-111, F-16 and certain other aircraft is to include an 8-mm band transmitter. There is also a report that work has been done to create millimeter-band on-board warning receivers.

The effectiveness of employing passive ECM equipment in the millimeter band is dropping since the narrow radiation patterns of electronic systems provide small resolution volumes. The foreign press has noted the ineffective use of chaff in the form of half-wave or quarter-wave oscillators made of aluminum for jamming systems operating at frequencies above 20-35 GHz. Experiments are being performed with various aerosols to create passive ECM resources in the higher frequency bands.

IN ASSESSING THE STATUS AND PROSPECTS FOR DEVELOPMENT OF THE MILLIMETER BAND, foreign experts note that the electronic systems in this band are finding increasingly wide use in the air forces of NATO countries. Their adoption is connected with a new stage in the development of precision weapons, inasmuch as high demands are being placed not only on accuracy, but also on the extent of around-the-clock and all-weather operation of such weapons. Judging from western press reports, there presently are several 8-mm band electronic systems in the foreign inventory, but the development of systems operating in the short-wave portion of the millimeter band is being delayed because of the lack of a reliable element base. For example, several experimental 3-mm band systems have been made and two of them have undergone the flight test phase (the TALONS radar and the Wasp guided-missile homing head). Only laboratory research is being done for now in the 2-mm and 1-mm bands. It is also reported that the Pentagon does not plan to fully replace existing electro-optical and SHF equipment with millimeter band systems. Consideration is being given only to variants of the rational joint use and integration of systems under development with those already in the inventory.

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SHIPBOARD HELICOPTERS IN ANTISUBMARINE WARFARE

Moscow ZARUBEZHNOYE VOYENNOYE OBOZRENIYE in Russian No 9, Sep 85 (signed to press 5 Sep 85) pp 53-58

[Article by Col N. Lavrentyev, doctor of military sciences, professor]

[Text] Viewing enemy submarines as the principal obstacle to achieving their aggressive objectives at sea, the naval commands of the United States and other imperialist states place great emphasis on antisubmarine warfare. Foreign military specialists believe that deck-based helicopters, employment of which substantially increases the tactical capabilities of antisubmarine forces, are one of the sufficiently effective means of antisubmarine warfare.

As emphasized in the foreign press, ship-based helicopters are assigned the following missions in the operations of antisubmarine forces: hunting and tracking submarines, guiding ships and issuing them target designations for the employment of weapons or destruction of the submarines on their own, and monitoring attack results.

The principal ship-based antisubmarine helicopters are the following: the SH-3D and SH-3H Sea King, the SH-2D and SH-2F Seasprite (Fig. 1 [figure not reproduced]) and SH-60B Seahawk in the U.S. Navy; the Lynx-HAS.2 (Fig. 2 [figure not reproduced]) in the navies of Great Britain, the FRG and France; the AB.212 ASW of Italy; and the HSS-2A and HSS-2B (produced under licensing on the basis of the American SH-3A Sea King) of Japan. There is group or solitary basing of helicopters aboard ships. Table 1 gives the performance characteristics of helicopters as well as the principal ship classes aboard which they may be stationed.

The SH-60B Seahawk (Fig. 3 [figure not reproduced]) of the ship-based LAMPS III helicopter multipurpose system is the most up-to-date in U.S. naval aviation. It is designed above all for the detection, tracking and precise position-finding of submarines and surface combatants for the purpose of their subsequent destruction.

Passive and active sonobuoys (RGB) are the SH-60B's principal means of detecting submarines. They are placed following measurement of the temperature distribution in depth and conditions for the propagation of sound waves in the water. To this end a hydrological survey buoy is dropped in the vicinity of

Table 1 - Principal Performance Characteristics of Ship-Based Antisubmarine Helicopters

Designation and Name of Country of Development	Crew	Maximum Take-Off Weight, kg / Empty Weight, kg	Maximum Cruising Speed, km/hr / Range, km	Antisubmarine Weapons and Special On-Board Equipment	Used by Naval Forces of	Principal Ship Classes Where Helicopters are Based (Number Aboard)
SH-3H Sea King,* USA	4	9525 / 5480	240 / 1,000	Four Mk 44 (Mk 46) torpedoes or four depth charges, radar, dipping sonar, sonobuoy, magnetic anomaly detector [MAD]	USA	Multirole aircraft carriers (8), "Spruance" Class destroyers (1)
					UK	"Invincible" Class antisubmarine carriers (9)
					Japan	"Hatsuyuki" Class guided-missile destroyers (1), "Haruna" and "Shirane" class helicopter-carrying destroyers (3 each)
SH-2F Seasprite, USA	3	5800 / 3040	240 / 680	Two Mk 44 (Mk 46) torpedoes, depth charge, radar, 15 sonobuoys, MAD	USA	"Belknap" (1) and "Ticonderoga" (2) class guided-missile cruisers, "Kidd" Class guided-missile destroyers (2), "Spruance" Class destroyers (2), "Oliver H. Perry" (2) and "Brooke" (1) class guided-missile frigates, "Knox" (1) and "Garcia" (1) class frigates
SH-60B Seahawk, USA	3-4	9900 / 6200	250 / 600	Two Mk 44 (Mk 46) torpedoes, radar, 25 sonobuoys, MAD	USA	"Ticonderoga" Class guided-missile cruisers (2), "Kidd" Class guided-missile destroyers (2), "Spruance" Class destroyers (2), "Oliver H. Perry" Class guided-missile frigates (2)
Lynx-HAS.2, UK-France	2	4300 / 2680	280 / 630	Two Mk 44 (Mk 46, Stingray) torpedoes or two depth charges, radar, dipping sonar, MAD	UK	"County" Class light guided-missile cruisers (1), "Sheffield" Class guided-missile destroyers (1), "Broadsword" (2) and "Amazon" (1) class guided-missile frigates, "Leander" Class frigates (1)
					France	Helicopter carrier "Jeanne d'Arc" (8), "Jorges Leygues" (2) and "Tourville" (2) class guided-missile destroyers, "La Galissoniere" (1) and "Duperre" (1) class destroyers
					FRG	"Bremen" Class guided-missile frigates (2)
AB.212 ASW, Italy	3-4	4760 / 2500	190 / 400	Two Mk 44 (Mk 46) torpedoes, radar, dipping sonar	Italy	"Vittorio Veneto" (8) and "Andrea Doria" (4) class guided-missile cruisers, "Audace" Class guided-missile destroyers (2), "Maestrale" (2) and "Lupo" (1) guided-missile frigates, and the frigates "Alpino" (2) and "Bergamini" (1)

*Helicopters of this type with certain modifications are produced under licensing in Great Britain (under the designation Sea King-HAS.1, 2 and 5), in Italy and in Japan (HSS-2A and B).

the target and optimum parameters for hunting submarines are determined from its data. American military specialists state that two helicopters of the LAMPS III system can perform a sufficiently effective search for submarines over a water area of some 80,000 km^2 (a quadrant with a side of 150 nm).

The SH-60B helicopters are capable of flying under adverse sea and weather conditions, with the ship rolling to 28°, with a trim up to 5° and with a pitch amplitude of up to 4.5 m. Ships are outfitted with a special safe landing system known as RAST (Recovery Assist Secure and Traverse). It is reported that the U.S. Navy intends to purchase 204 such helicopters and provide them primarily to ships of the frigate and destroyer types.

Merchant vessels also are being fitted with landing pads for the helicopters, which will reduce the need for close escort ships, in the opinion of foreign specialists. Despite the high effectiveness of helicopters in the convoy antisubmarine defense system, however, there are difficulties here as well: the need for special helicopter servicing, flight support, their use of weapons, accommodation of flight and technical personnel, and fuel supply. Moreover, fitting vessels with helicopter take-off and landing pads and hangars leads to a 10-30 percent reduction in their cargo capacity.

The western press emphasizes that a trend has appeared in recent years toward the creation of mobile modular systems easily installed aboard transports and also simple to dismantle. This does not require a significant refitting of vessels and doesn't do great harm to their cargo capacity. This concerns standard cargo containers with equipment which are delivered aboard and then joined together according to a previously worked-out arrangement. Using this principle, for example, the United States developed the Arapaho shipboard container system intended for installation aboard container carriers and Great Britain developed the DEMS-2, the principal elements of which are antisubmarine helicopters. According to foreign specialists, it takes no more than 40-48 hours to assemble the systems.

Ship-based helicopters have dipping sonar (OGAS), sonobuoy systems, magnetic anomaly detectors and radars aboard for detecting submarines, and antisubmarine torpedoes and bombs with nuclear and conventional warheads for their destruction.

Helicopters' capability of hovering over a certain point on the water's surface and monitoring the horizon led to creation of dipping sonar. The dipping sonar registers a noise (audio) field arising in the water during the movement of a submarine (the passive sonar mode), and also uses the echoes reflected from a submarine in illuminating her with the acoustic energy of the set itself (the echo ranging mode).

The passive sonar mode provides for secrecy of surveillance, but only permits determining the direction (bearing) to a target. It is the opinion of foreign specialists that the absence of an opportunity to measure the distance to the target is a serious deficiency of that mode. The bearing and range to a submarine are determined in echo ranging at distances of up to 15-18 km. Echo ranging provides a certain advantage in comparison with the passive sonar mode in connection with the fact that the noise level of submarines has been

reduced substantially in recent years. The echo ranging mode, however, reveals the helicopter hovering in the vicinity of a submarine and as a result the submarine can promptly detect the operation of the dipping sonar and execute an escape maneuver.

Sonobuoy systems are one of the principal means of detecting submarines. They include on-board receiving and recording equipment and sonobuoys which are dropped into the water on parachutes. The sonobuoys may be active or passive. After the buoys hit the water their hydrophones descend on a cable to a certain depth, which is calculated according to optimum conditions for the propagation of sonar signals in the given area of the sea, and the equipment is placed in a working condition. When a submarine enters the sonobuoy coverage, her noises or a signal reflected from her are registered by the buoy equipment, amplified and sent over the air. An operator aboard the helicopter receives these signals, classifies them and thus establishes the fact of an underwater target's presence in the search area. According to foreign press data, the operating range of the buoys can reach 10 km.

A substantial deficiency of the sonobuoys, in the opinion of foreign specialists, is the one-time nature of their use and their limited operating time, as a result of which it is necessary to drop new sets of buoys regularly when hunting submarines over large areas as well as during a lengthy tracking of them, while the store of sonobuoys aboard the helicopter is limited.

Airborne magnetic anomaly detectors register slight changes of the Earth's magnetic field caused by the appearance of a metallic mass (a submarine) within their effective range. They can detect submarines at relatively short distances (300-700 m), and so, as the foreign press notes, they are used only in combination with other means of surveillance. In addition, magnetic anomaly detectors are subject to strong effects of various types of magnetic fields.

Radars allow the detection of submarines while in a surface condition and with masts out of the water. The mean ranges for radar detection of submarines are over 35 km in a surface condition, 15 km when snorkelling and up to 5 km with periscope up. In connection with the fact that nuclear-powered submarines may be constantly in a submerged condition at sea, a search for them with radars essentially has lost its importance. Radars usually are employed in combination with other search resources.

Torpedo ordnance continues to hold a prominent place among the airborne means for destroying submarines. Acoustic homing torpedoes with passive and active or active-passive guidance systems are the most widespread aboard. In the first instance a passive sonar is the system's sensing element, in the second instance it is an echo-ranging set and in the third instance it is a combination of the two previous ones.

The Mk 44 and Mk 46 (developed by the United States), Stingray (Great Britain) and A244 (Italy) are the most widespread small antisubmarine torpedoes being employed from helicopters. Their performance characteristics are shown in Table 2. Western military specialists note that in the foreseeable future torpedoes will remain the principal and a rather effective weapon in

antisubmarine warfare. Helicopters also can employ depth charges, including nuclear depth charges.

Table 2 - Principal Performance Characteristics of Antisubmarine Torpedoes

Torpedo type, country, year became operational	Caliber, mm / Length, m	Weight, kg Total / Explosives	Speed, knots / Range, km	Maximum running depth, m	Guidance system
Mk44 Mod. 1, USA, 1960	324 / 2.56	196 / 34	Up to 30 / 5.5	300	Acoustic passive
Mk46 Mod. 1, USA, 1967	324 / 2.59	230 / 44	Up to 45 / 9	450	Acoustic active-passive
Stingray, UK,	324 / 2.7	215 / 45	40 / 7.5	Around 700	Same as above
A244, Italy, 1976	324 / 2.67	215 / 40	Up to 33 / 6	Around 450	Same as above

The widespread nature of deck-based helicopters in naval forces of the capitalist states is determined by their tactical capabilities and the ability to operate from the majority of modern ships and vessels (Fig. 4 [figure not reproduced]). In comparison with antisubmarine ships, their tactical advantage is high speed in surveying an area; the possibility of surprise appearance over a submarine and establishment of contact before she is able to evade detection; and the capability of more lengthy tracking of a fast underwater target. The helicopter can deploy its detection equipment and weapons without restriction while remaining practically invulnerable.

In the opinion of American military specialists, the helicopter has certain advantages even over a deck-based antisubmarine aircraft. For example, having the possibility of changing flight speed from a hover position (zero speed) to maximum, the helicopter is able to move relatively quickly to sectors where there is a threat of submarine operations. During antisubmarine support of ship forces and convoys the helicopter can accompany them at a speed commensurate with the movement of ships and vessels, stay above a detected submarine for a long while and pursue her. In addition, the helicopter is not tied to an aircraft carrier like an aircraft and can operate from practically any vessel or ship.

Helicopters increase the usual "density" of underwater surveillance within the arrangement for antisubmarine defense of a ship force or convoy during the sea passage. They operate as part of close escort forces (within a radius of up to 20 nm from the center of the order).

Helicopters can search for targets alone, in a pair or as part of a helicopter hunter-killer group. In the latter two instances one or two helicopters are used to hunt and one is employed in the attack version.

The foreign press indicates that when employing dipping sonar, the helicopter's sequence of actions is as follows: it hovers over the calculated point

at a height of up to 4.5-6 m above the sea surface (Fig. 5 [figure not reproduced]); lowering the set's acoustic antenna on a cable, it surveys the horizon for 4-5 minutes, usually in the active mode. If no target is detected the helicopter raises the antenna and flies to the next point, which is a distance of 1.25-1.6 of the dipping sonar's effective range from the first point. The helicopter must maintain contact with a submarine for at least two minutes to determine her course and speed. The number of hovers in a search (an average of 10-15) is determined by the type of helicopter, characteristics of its on-board equipment, and the distance from the ship. Helicopters usually proceed ahead of the close escort ships along their course.

Sonobuoys are placed in areas where submarines already have been detected, and in the form of barriers along convoy routes in sectors where there is a threat of submarine attack. After placing a sonobuoy barrier, the helicopter patrols above it, detects submarines attempting to penetrate through its line, and promptly notifies escort ships and other ASW forces. Steps are taken to destroy the detected submarine based on these data.

Helicopters may be employed not only independently, but also in coordination with antisubmarine aircraft, which have a greater radius of action. Aircraft determine a submarine's location and inform escort ships of the coordinates. Based on these data, helicopters use the entire set of antisubmarine search resources to update the target location, they employ weapons and, if the attack was unsuccessful, they vector ships to the submarine.

The ships on which helicopters are based are outfitted with the necessary technical resources supporting helicopter activities. The ship's combat information center exercises the principal control and supervision over helicopter flights. It maintains continuous communications with the crew and informs the pilot of a change in weather conditions, the ship's course and speed, loss of radar contact with the helicopter, and other information.

The foreign press notes that the role of ship-based antisubmarine helicopters is constantly growing. They are becoming an inalienable and most effective part of the maneuverable antisubmarine forces of capitalist navies, which are a tool of ruling imperialist circles in implementing their aggressive schemes.

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NATO JOINT NAVAL FORCES' SPRING EXERCISES IN THE BALTIC STRAITS ZONE

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[Article by Capt 1st Rank V. Khomenskiy; passages rendered in all capital letters printed in boldface in source]

[Text] A series of spring exercises was held by the NATO Joint Naval Forces in the Baltic straits zone in the period from 16 April through 16 May 1985 under the codenames Blue Harrier-85, Bold Game-85 and Bright Horizon-85. They were connected by a common concept and conducted against a single operational-strategic background. The exercises worked on problems of employing mixed forces of the joint navies in coordination with air forces' tactical aviation in defense of the Baltic Sea strait zone, in disruption of the deployment of enemy naval forces from the Baltic Sea into the North Sea, in protection of sea lines of communication, and in antilanding defense of islands.

The basis of the exercise concept was a provocative version of international tension being whipped up by Warsaw Pact countries (the "Orange" side) and military actions being unleashed in the North European Theater of Operations. In response to this, the "Blue" side (the NATO countries) was forced to carry out accelerated mobilization and deployment of the FRG and Danish navies and reinforce them with ships of the standing NATO naval force in the Atlantic and from national navies of the United Kingdom and Norway. With active defensive operations in the strait zone, they seal the Orange fleet in the Baltic Sea, disrupt its landing operations on Danish islands and assume the offensive. At the same time, after regrouping forces within the theater, the Blue side dislodges the "enemy" into the eastern part of the Baltic Sea.

EXERCISE BLUE HARRIER-85 was held from 16 through 28 April in Helgoland Bay and on the western approaches to the Jutland Peninsula. Primary emphasis was placed on practicing lessons of countering the mine threat on the most important sea lanes in the southeastern part of the North Sea and on approaches to bases and ports, as well as of laying minefields on the most likely enemy ship routes and in areas of coastal sectors accessible for landing. Over 40 combatant ships and auxiliary vessels, and aircraft and helicopters of coastal patrol, reconnaissance and tactical aviation were used in the exercise. It was directed by West German Vice Admiral (H. Kampe), commander in chief of NATO Joint Naval Forces in the Baltic strait zone.

During the exercise a grouping of naval forces in the Baltic strait zone was reinforced by ships of a standing command of minesweeping forces in the English Channel zone and with American Sea Stallion minesweeping helicopters. Ship minesweeping groups and detachments of support ships formed and deployed in their operational areas. They practiced laying minefields in areas of Helgoland Bay and conducted exploratory test sweeping and live sweeping of minefields using minesweeper hunters, West German Troika hunting and sweeping systems and the American Sea Stallion minesweeping helicopters. Mine-specialist swimmers were used to neutralize and destroy mines on approaches to naval bases and ports and directly in the bases. Tactical aircraft covered the minesweeping forces from the air and E-3A airborne warning and control aircraft of the NATO AWACS command conducted surveillance of the surface and air situation in the operating area.

EXERCISE BOLD GAME-85 was held from 23 April through 10 May. Its principal objective was to improve the tactics of employing light naval forces (primarily guided missile patrol boats and torpedo boats) in defense of the Baltic strait zone during the first operations of an initial period of war. Over 50 combatant ships, small combatants and auxiliary vessels of navies of the FRG, Denmark and Norway as well as land-based reconnaissance patrol aircraft and tactical aircraft of these countries and Great Britain took part. The exercise was directed by Danish Lt Gen N. (Ryue)-Andersen, commander in chief of NATO Joint Armed Forces in the Baltic strait zone.

The exercise was preceded by a command and staff run-through of its individual components by the Baltic strait zone command and by force commanders in the city of Kristiansand.

Primary emphasis during the exercise's main phase was placed on defense of the Baltic Sea strait zone from the west and east for the purpose of disrupting reinforcement of "enemy" naval groupings in the Baltic Sea and preventing the deployment of his forces into the Atlantic. Guided-missile patrol boats operating in ship striking forces opposed the penetration of a detachment of "enemy" combatants supported by tactical aircraft into the strait zone from the North Sea. Strikes were delivered against ships by Harpoon and Exocet missiles and by bombs and cannon of tactical aircraft.

Three or four groups of guided-missile patrol boats operating out of ambush or by means of raiding operations, together with tactical aircraft, opposed the penetration of "enemy" combatants into the strait zone from the Baltic Sea. Sea King helicopters were used to vector groups of "enemy" ships. The E-3A AWACS aircraft were widely used to reveal the surface situation.

EXERCISE BRIGHT HORIZON-85 was held from 7 through 16 May in the northeastern part of the North Sea and Skagerrak Strait to practice methods and tactics of employing mixed forces during combat actions on western approaches to the Baltic Sea strait zone. Some 40 combatants and auxiliary vessels (including up to six ships of the standing NATO naval force in the Atlantic) and over 40 aircraft of the air forces and navies of the FRG, Denmark, Norway, Great Britain and the Netherlands took part in the exercise. Overall direction of the exercise was by British Lt Gen R. (Lowson), commander in chief of NATO Joint Armed Forces in the North European Theater of Operations, and immediate

command and control was by Lt Gen N. (Ryue)-Andersen, commander in chief of NATO Joint Armed Forces in the Baltic strait zone.

During the exercise tactical procedures of hunting, tracking and destroying "enemy" submarines with maneuverable antisubmarine forces were practiced, antisubmarine barriers were established to disrupt the deployment of "enemy" submarines from the Norwegian Sea into the North Sea, and measures were taken to protect sea lines of communication in the interests of escorting convoys with troop reinforcements and military cargoes into the Baltic strait zone. Submarines, tactical aircraft, guided-missile patrol boats and torpedo boats offered opposition to the convoys during the sea passage. The E-3A AWACS aircraft took an active part in the exercise. They detected the convoys and vectored striking forces of ships, small combatants and tactical aircraft to them.

In the exercises great emphasis was placed on practicing the organization of command and control and communications, reconnaissance, logistical support to forces at sea and in bases, coordination among branches of armed forces and combat arms in conducting joint combat actions, and the use of electronic countermeasures.

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SHELTERS FOR SUBMARINES AND SURFACE COMBATANTS OF EUROPEAN NAVIES

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[Article by Capt 1st Rank A. Melnikov; passages rendered in all capital letters printed in boldface in source]

[Text] Special shelters for submarines and surface ships have been created on the territory of naval bases and ports of a number of Europe's capitalist states. The foreign press reports that 12 naval bases and ports of Norway, Sweden, France and Turkey have been outfitted with such facilities. These countries presently have two types of shelters: underground rock shelters and reinforced concrete surface shelters.

ROCK SHELTERS have been built on naval bases of Norway (Håkonsvern and Olavsvern) and Sweden (Horsfjord) and at a Turkish naval basing point (Bartin). They were built in the 1960's and, in the opinion of foreign specialists, completely provide for protected anchorage, repair (including docking) and maintenance of submarines and surface ships up to and including destroyers.

Shelters placed in operation in 1971 at the main Swedish naval base of Horsfjord (near Stockholm) are of greatest capacity based on their engineering preparation and technical outfitting. In the command element's opinion, the country's naval forces have considerable capabilities for sheltering their combatants in tunnels made in the cliffs of the skerries by explosives. Initially it was believed that the principal purpose for building the tunnels was to use them for repairing damaged ships. The western press notes that now the combination of underground repair bases and the large number of basing points in the country's vast skerries regions creates good conditions for reliable shelter and camouflage for the Navy's main forces.

There are nine tunnel shelters on the territory of the Horsfjord main naval base. Four of them are located on Muskö Island and are part of an underground naval yard which includes three drydocks (two for destroyers and one for submarines) and a slip for guided-missile patrol boats and torpedo boats. They are for the repair (docking) and maintenance of ships up to and including destroyers. The slip's ship lifting arrangement permits "Spica" Class torpedo boats or similar craft to be hoisted. The slip areas are designed for the

simultaneous repair of four small combatants. The width of the entrance into the dock shelters is 10-15 m. Tunnel entrances are closed with special gates controlled from the base command post with the help of an automated system.

The rock shelters on Muskö Island are connected with the mainland part of the naval base by a 3-km underground highway tunnel which is 35 m deep at its deepest point and 15 m wide. It has three air ventilation plants and four special vehicle parking bays.

The other five shelters in Horsfjord are for submarine basing (Fig. 1 [figure not reproduced]). The tunnel entrances are 10 m wide and the underground facilities are 20-30 m deep.

According to foreign press reports, the base on Muskö Island can provide protection for ships (destroyers, submarines, guided-missile patrol boats and torpedo boats) and their personnel in contemporary nuclear war. It is located in a cliff 50 m high and has a self-contained electric power station, weapon and ammunition stores, a hospital, fresh water and food storage areas, and administrative and living spaces. The base is equipped with a system of steel gates which, in case of a threat of nuclear attack, close all entrances to the cliff, divide its underground territory into compartments and thus assure the invulnerability of ships and personnel and the base's survivability as a whole.

There are similar facilities at the Norwegian Navy's main naval base of Håkonsvern (near Bergen), where there are five rock shelters. A drydock providing for the repair (docking) of submarines and surface combatants up to and including destroyers has been built in one of them. The entrance, which is covered by a nylon camouflage net, is 20 m wide, 30 m high and 10 m deep at the sill. Four other tunnel shelters provide anchorage and maintenance for four submarines. The tunnel entrances are around 10 m wide and 8 m high. The underground facilities are approximately 50 m deep.

Submarine bases have been built in the rock at the Olavsvern naval base in Norway and at the naval basing point of Bartin, Turkey. Each of them has the appropriate shops and ammunition dumps and allows for basing up to 4-5 submarines.

REINFORCED CONCRETE SURFACE SHELTERS built in World War II times are being used, after appropriate modernization, at naval bases of France (Brest, Lorient, La Pallice) and in the Norwegian port of Bergen for the basing and repair of diesel submarines and small surface combatants. It should be noted that similar shelters were built for fascist Germany's submarines during World War II on the territory of another ten naval bases and ports of Germany, France, the Netherlands and Norway (their total capacity was up to 255 units). There were no submarine losses at bases with shelters located on the French coast up to the end of 1943 despite vigorous actions by British aviation. They have been preserved to the present time only in the Norwegian port of Trondheim and the French port of Bordeaux, but they are not being used for their original purpose.

The largest reinforced concrete surface shelters are located at the Lorient naval base (Fig. 2 [figure not reproduced]), where there are four such structures consisting of a total of 30 basins (sections), seven of which are fitted out with drydocks. The shelters are 150-180 m long, from 60 to 150 m wide and 30 m high. The drydocks are some 90 m long. There is a slipway with a lifting capacity of 1,000 tons. The overhead cover is 7.5 m thick. The shelters hold a total of up to 35 submarines, small ships and patrol boats.

There is one such shelter each at the naval bases of Brest (15 basins) and La Pallice (10 basins). In each of them 8-10 basins are fitted out as drydocks 88-115 m long. The overhead cover is 4.5-6 m thick. They can provide for basing up to 20 submarines and patrol boats at Brest and up to 15 at La Pallice.

The Norwegian port has a reinforced concrete shelter for docking two diesel submarines.

And so the military-political leadership of a number of West European states is placing great emphasis on the construction and improvement of hardened shelters for submarines and surface combatants, regarding them as one of the most important elements of their navies' combat support. According to foreign press data, these states presently have some 30 shelters of different types capable of accommodating over 120 submarines, surface ships and patrol boats and supporting their repair, docking and all kinds of technical servicing.

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NEW ARGENTINE TRAINER

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[Article by Col I. Karenin]

[Text] Argentina began flight testing of a new IA.63 Pampa trainer aircraft developed under contract from the country's Air Force by the state aircraft company Fabrica Militar de Aviones with technical assistance from the West German firm of Dornier. The first flight of the aircraft prototype lasting 50 minutes took place in October 1984, during which a speed of Mach 0.65 and an altitude of around 7,000 m were reached (see figure [figure not reproduced]).

The IA.63 is a two-place monoplane with a supercritical, nonswept shoulder-wing, single-fin tail unit and tricycle landing gear with nose wheel. The foreign press notes that new composition materials were used in the new aircraft's design for the first time in the practice of Argentine aircraft construction; the air brakes, tail fin, wingtips and fuselage tail cone are made of them in particular. The ejection seats of the crew members (student and instructor) are arranged in a tandem configuration. The power plant consists of one Garrett TFE731-2-2N turbofan engine with a maximum thrust of 1,590 kg. The fuel reserve (980 liters) is accommodated in integral wing tanks (580 liters) and a fuselage tank (400 liters). The aircraft's principal design characteristics are given below.

Weight, kg:	
Maximum take-off	4,650
Normal take-off	3,500
Landing	3,300
Maximum speed near surface, km/hr	740
Maximum rate of climb near surface, m/sec	27
Service ceiling, m	12,900
Length, m:	
Take-off run	700
Landing run	850
Flight range with maximum fuel at 4,000 m at a speed of 550 km/hr with flying weight of 3,800 kg, km	1,500

Aircraft length, m	10.93
Height, m	4.29
Wingspan, m	9.69
Wing area, m^2	15.63

Judging from western press reports, 64 IA-63 Pampa aircraft have been ordered for the Argentine Air Force to replace obsolete trainers. It is planned to begin series production in 1986. Fabrica Militar de Aviones intends to produce 300 aircraft, of which 200 will be exported.

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